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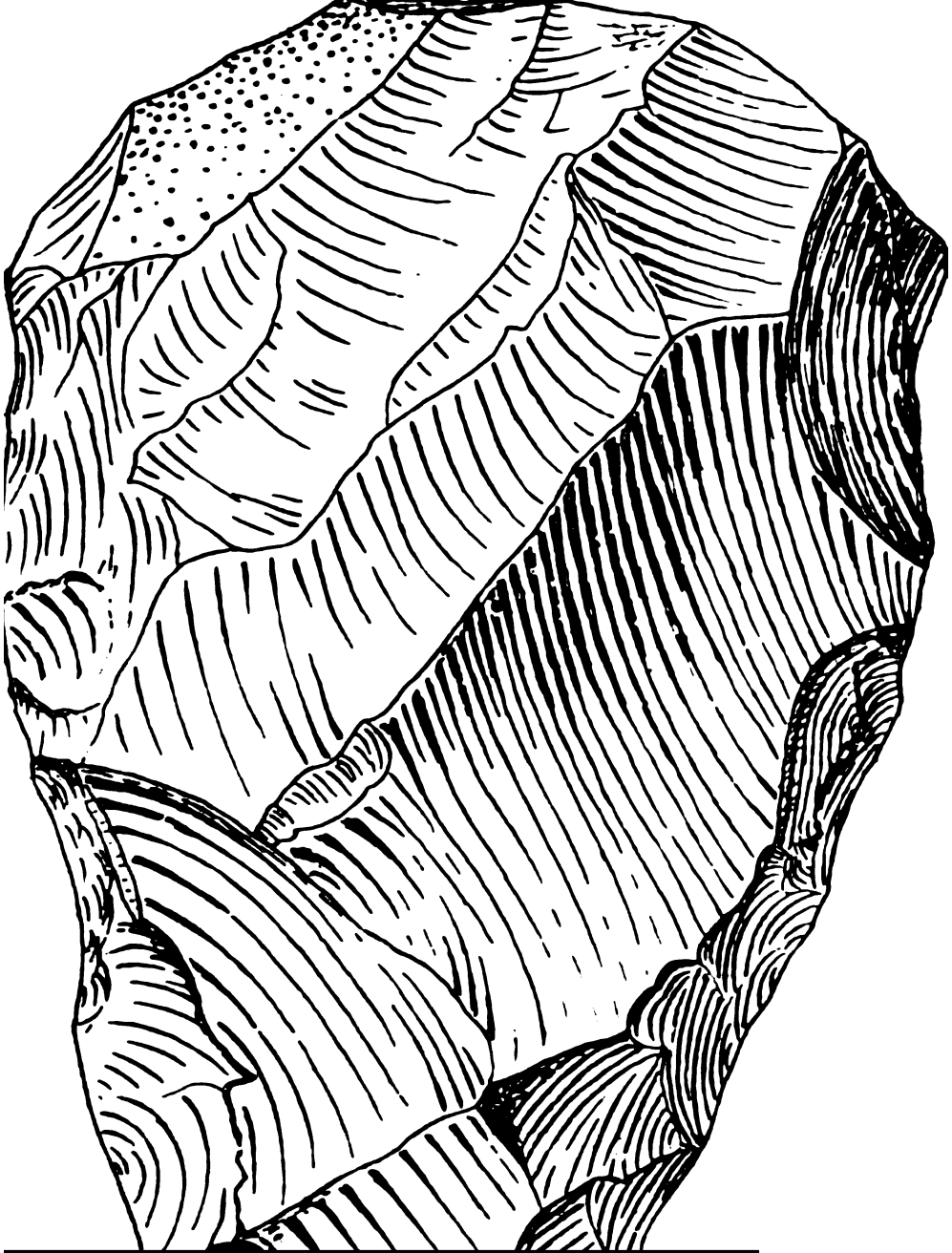
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"Men that undertake only one district are much more likely to advance natural knowledge than those that grasp at more than they can possibly be acquainted with. Every kingdom, every province, should have its own Monographer."—GILBERT WHITE, of Selborne.

"Things seen are mightier than things heard."—TENNYSON.

[The authors alone are responsible for the statements and opinions contained in their respective papers.]

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"Stand still and consider the wondrous works of God."

JOB.

"O Nature! Ha! Why do I not name thee God? 'Art thou not the living garment of God.'"

CARLYLE.

"The harp at Nature's advent strung,
Has never ceased to play;
The song the stars of morning sung,
Has never died away."

WHITTIER.

"Science lives only in quiet places,
and with odd people, mostly poor."

RUSKIN.

"Nature smiles as sweet, I ween,
To Shepherds as to Kings."

BURNS.

"In every landscape the point of astonishment is the meeting of the sky and the earth, and that is seen from the first hillock as well as from the top of the Alleghanies."

EMERSON.

"What! dull, when earth, air, and water are alike mysteries to you, and when as you stretch out your hand you do not touch anything the properties of which you have mastered; when all the time Nature is inviting you to talk earnestly with her, to understand her, to subdue her, and to be blessed by her! Go away, man: learn something, do something, understand something, and let me hear no more of your dulness."

ARTHUR HELPS.

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8-6

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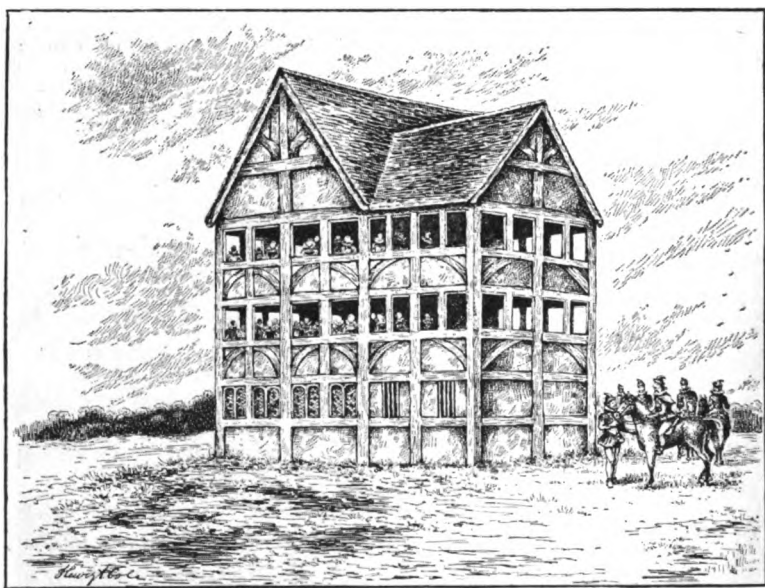
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ERRATA.

- Page 26 line 6 from foot, for "reclamation" *read* reclamation.
,, 82. The Family heading, PLEURONECTIDÆ, should be placed above
Hippoglossus vulgaris.
,, 88 lines 5 and 6, the stones from Grays, presented by Mr. Kennard, were
Neoliths, not Eoliths.
,, 108 line 10, for "Church" *read* Clinch.
,, 137 line 4 from foot, for "28" *read* 82 (an error of errors!)
,, 207 line 1 from foot, for "flowering" *read* flourishing.
,, 255 line 10, from foot, for "1904" *read* 1903.
,, 236 line 18, for "Mildred" *read* Hildred.
,, 273 line 10, for "right" *read* left.
,, 293 line 1, for "ÆUSTILAGINE" *read* USTILAGINEÆ.
,, 301 line 8 from foot, for "*squarmaria*" *read* *squamaria*.
,, 302 line 11 from foot, for "*Galinisoa*" *read* *Galinisoga*.
,, 324 line 18 from foot, for "goede" *read* geode.
,, 325 line 16, for "cavites" *read* cavities.
,, 333 line 18, for "Prestwick" *read* Prestwich.

To Binder.—Substitute reprint of pp. 367-8 inserted in Pt. I. vol. xiv., for original
pages.
Place Prospectus of Photographic Survey of Essex (inserted in Pt. 7) at
end of text in binding of volume.



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Honorary Secretary and Curator.

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OVER CRAB-TREE HILL, HAINHAULT FOREST.

Pencil drawing by H. A. Cole, February 9th 1903.

THE
ESSEX NATURALIST:

BEING THE
Journal of the Essex Field Club

FOR 1903-1904.

(VOLUME XIII.)

PROPOSALS FOR A PHOTOGRAPHIC AND
PICTORIAL SURVEY OF ESSEX.

By ALBERT E. BRISCOE, B.Sc., A.R.C.Sc., &c., *Principal of the
Municipal Technical Institute, West Ham.*

[Read January 31st, 1903.]

THERE is but little need in these times to point out the value to historical students of contemporary pictorial records: every one is familiar with the interest that attaches to old prints and drawings. A splendid example of the way they may be used to illuminate history and to give valuable information regarding the social life of the people is the well-known illustrated edition of John Richard Green's *Short History of the English People*.

No books give us such a vivid understanding of the social life of the Eighteenth Century as is given by the prints of Hogarth; to our descendants, pictures like Frith's "Derby Day" and "Railway Station," will be equally valuable.

We live in a time of great changes; probably the changes in the appearance of the country during the next fifty years will be even more marked than those of the last fifty. Old customs are fast dying out; old houses are disappearing, and no record of either is being left behind.

Those of us who have lived in Metropolitan Essex during the last decade know this only too well. However, even yet there are bits of the old villages buried away in out of the way corners of the new towns that are springing up like mushrooms in "London over the border."

Within the last five years, old Rokeby House has disappeared

A

from Stratford, and not five minutes' walk of the Technical Institute there are relics of the once rural hamlet of Stratford that will probably vanish before another ten years are out. Opposite the Institute is a gateway which is one of the best examples of wrought iron work in the London district. Others like it have disappeared.

Essex is peculiarly rich in such objects of interest, and it behoves a body like the Field Club to see that everything is done to secure records before these things vanish completely.

Fortunately, in Photography, we have a ready and rapid method of securing such records, that was not available to our ancestors, and by combined action much can be done.

The oldest Photographic Survey in this country is not yet twenty years old. To Warwickshire and to the photographers of its chief city, Birmingham, belong the honour of beginning this work. The prints are stored in safe keeping in the Birmingham Free Libraries, under the care of the City Council. Since Warwickshire started, several other surveys have been arranged for, including a very successful one in the neighbouring Home County of Surrey; in our own district the enthusiastic photographers at Woodford have, I believe, begun work on their own account.

In all cases the method of work is to enlist as many helpers as possible. Negatives are taken; then prints by some permanent process are made and sent to a central body, and by that central body catalogued and stored in such a manner as to be readily available for examination.

What body is more fitted to take up this matter than the Essex Field Club, with its members scattered all over the whole County?

The cost of making such a collection will be mainly the expense of cataloguing and storage. Storage accommodation can be found at the Passmore Edwards Museum, West Ham, the Club's head-quarters, and I think there will be little difficulty in inducing the Museum Committee of the West Ham County Borough Council to defray out of the funds already set apart for the upkeep of the Museum, the comparatively small expense of cataloguing, mounting, storing, and exhibiting the prints.

The scheme of work that seems most likely to give the best

results is to map out the country into districts and enlist as many local helpers as possible. Negatives would be taken by the local helpers and their friends, and prints by some permanent process, such as the platinum or carbon processes, would be made by them and forwarded to headquarters unmounted. Such prints should be accompanied by descriptive labels, giving information as to the object photographed, the date on which the negative was taken (this may be of the greatest importance), the process used for printing, and the name and address of the photographer. Whole plate and half plate should be the standard sizes for prints, but of course quarter plates would have to be accepted for hand camera work.

These prints would then be carefully mounted, labelled and stored in such a fashion that ready reference would be secured.

The Warwickshire prints are all mounted on card with sunk mounts, and are then bound into book form for storage. If the main object of the survey be, as it should be, the preservation of such records for future reference by serious students, this method seems to me to be not the best that could be adopted. Often reference to a particular district means referring to a large number of bulky volumes. Further, it is next to impossible to secure that card mounts shall be made of materials sufficiently pure to prevent the mount damaging the print; neither does the material of which such mounts are made possess the necessary lasting qualities. Suitable mounts can be made only out of the purest paper.

The method of mounting and storage that I would suggest is illustrated by the sample shown by me at the meeting of the Essex Field Club in January last.

The prints are mounted on paper of good quality, about the thickness of stout cartridge paper. All mounts are of foolscap size, and will take a whole plate, a half plate, or two quarter plate prints. Descriptive matter can be written on the back of the mount. The prints are attached to the mount by *pure* starch paste. The mounts are then bound together in a foolscap size "Stolzenberg" File, each photograph being protected by a sheet of tissue paper, bound in by the file between each mount. These files will hold about 50 to 100 of such mounts. They allow the prints to be examined as easily as though they were bound up like a book, and yet permit of the removal of any one

print or the re-arrangement of the whole set without damaging them in any way.

The files themselves are very inexpensive, costing about 5d. each; it will probably be found advisable to replace the steel binder by one made of a non-rusting metal like aluminum. To protect the file and its contents from dust it could be placed in a large envelope.

Prints should be bound together according to locality, and by filing the cases away in an alphabetically indexed cabinet the arrangement would be self indexing. Cross-indexes of subjects, etc., could easily be made with little trouble, if started when the collection was begun and kept carefully up to date.

Every year it would be well to arrange for a public exhibition of the prints contributed during that period, and from time to time series of prints referring to special subjects or districts could be exhibited either in the museum or elsewhere.

With this exception only those who desire to make use of the collection for serious purposes should have access to it, the main object of the collection being not to provide a series of interesting pictures for the general public, but to supply historical material for future generations.

As regards subjects for illustration, they begin to multiply the more one thinks about them ; certainly they should include the following :—

- (a.) Archæological subjects (old houses and churches, and old buildings of every description).
- (b.) Prehistoric remains.
- (c.) Passing events of importance.
- (d.) Portraits of public men connected with the County.
- (e.) Illustrations of old customs.
- (f.) Natural history subjects, such as Geological sections, Photographs of growing plants, and of animals with their natural surroundings.
- (g.) Photographs illustrating the social life of the people.

This latter class (g) of subject is perhaps the one that will be of most value a hundred years hence, and yet it is the one most likely to be over-looked. Photographs illustrating daily life in the docks, factories, and streets, and on the river ; interiors and exteriors of typical dwelling-houses ; street markets ; street salesmen ; out-door meetings such as those held in the Grove,

Stratford, and at Beckton Road corner, Canning Town ; sports and games ; holiday-making crowds in Epping Forest, and the like will all be of immense interest to those who come after us.

Photographs of some of our slums will show our descendants under what conditions many of us were forced to live, and photographs of some of our local governing bodies at work may not be without their interest.

If the Survey is to be a success, willing helpers will be needed all over the County, working under the guidance and advice of a central organisation, which might well be a small special Committee of the Essex Field Club. Before many years have passed, a collection of photographic records will be built up which may be of untold value to future students of history.

Nor need we confine ourselves to photographic records only. Records of things that have passed away already remain in the shape of prints and drawings ; such might well find a permanent home where they are easy of access in the Museum of the Club.

WORK IN THE FIELD AMONGST THE FUNGI.

WITH ADDITIONS TO THE FLORA OF EPPING FOREST MADE AT THE FUNGUS FORAY, 1902.

By M. C. COOKE, M.A., LL.D., A.L.S., &c.

IF I were to follow the practice of an eminent, and now deceased, politician, I should name three courses, or class my few observations under three heads, as

- (I.) *The work of to-day ;*
- (II.) *The work of the year ; and*
- (III.) *The work of the future.*

All I may have to say would fall under one of these.

The *work of to-day* summarizes what has been accomplished yesterday and to-day, with a sort of prologue, setting forth what was done in Epping Forest by the South London Field Club on the first Saturday in October, when the specimens submitted to me for identification numbered 47, including one species which I never before have seen collected in the County of Essex, and

that was *Gomphidius gracilis*. B. Common nowhere, but chiefly found in the West of England. A somewhat uncommon species in the Forest district was *Inocybe pyriodora* with the odour of pears, but it has been recorded previously in our lists. I was glad also to see *Boletus versipellis*, which the velvety pileus, and rather peculiar scaliness of the stem, distinguishes from the red form of *Boletus scaber*, with which it has often been confounded.

Notwithstanding the unfavourable dry winds of late, and the scant appearance of Fungi in the Forest, the Foray of 1902 has been the most successful for many years, if we measure success by the number of species found which are new to the Forest district. There was one peculiarity which may be noted, as such facts may ultimately prove to be of service, that some of the usually common species were almost, or entirely absent, whilst others were extremely common. It was remarkable to observe the profusion of *Amanita phalloides*, *Collybia butyracea*, *Collybia maculata*, *Lactarius turpis*, and *Marasmius peronatus*, and equally strange that only one specimen of *Cantharellus cibarius* was seen, and not one of *Cantharellus aurantiacus*, only one *Amanita rubescens*, hardly any species of *Tricholoma*, only two or three specimens of the *Rhodospora*, very few *Boleti*, including one *Boletus edulis*, and two of *Boletus scaber*, which are usually so common. One solitary specimen of *Collybia dryophila*, one *Psilocybe semilanceata*, and very few *Cortinarii* or *Hygrophorii*. Mycologists who have been accustomed to rambles in the Forest will realize at once the singularity of the fungus flora of the year.

The additions to the Forest Flora were as follows:—

Tricholoma stans, Fr. Cooke *Illus.* pl. 198.

Clitocybe tuba, Fr. Apparently not before recorded.
Cooke *Illus.* pl. 112.

Collybia stridula, Fr., not figured.

Collybia tenacella, Fr. Cooke *Illus.* pl. 152b, 640.

Mycena flavo-alba, Fr. Cooke *Illus.* pl. 159b.

Mycena ætites, Fr. Cooke *Illus.* pl. 188a.

Pholiota aurivella, Batsch, Cooke *Illus.* pl. 351.

Hebeloma petiginosa, Fr. Cooke *Illus.* pl. 508b.

Psalliota comptulus, Fr. Cooke *Illus.* pl. 553.

Russula ochracea, A. and S. Cooke *Illus.* pl. 1050.

Russula nitida, Pers. Cooke *Illus.* pl. 1062 1063.

Marasmius vaillantii, Fr. Cooke *Illus.* pl. 1126a.

Marasmius sclerotipes, Bond, identified with the *Collybia cirrhata* of Cooke's *Illustrations* pl. 144b, which is not the *Collybia cirrhata* of Fries.

Marasmius candidus, Bolton. Determined by Massee and myself from specimens brought away from the foray.

Polyporus (Fomes) connatus, Fr.

Helotium fructigenum, Bull.

Daldinia concentrica, De'Not.

In addition to

Gomphidius gracilis Berk, which was collected in the Forest by the South London Field Club, a fortnight previously. Thus making an addition to the Forest Flora of 18 species.

The total number of species determined, by myself and Mr. Massee on the 17th and 18th was 134, which is in excess of the usual number found at a forest foray, and with far fewer collectors than on most occasions, and under rather unfavourable weather.

None of the species recorded are positively new to Britain, although *Collybia stridula* has probably been recognized only once before in this country. *Tricholoma stans*, however, must be regarded as a rare species in Britain, and *Russula ochracea* is by no means common. *Gomphidius gracilis* has apparently been confined hitherto to the north and west of these islands, and is only found occasionally, so that it may be regarded as a rare species.

II.—THE WORK OF THE YEAR.

This may consist of local work, and of general work which would affect local work, as in the case of literature.

Of local work little can be said, except that there appears to me to be a diminution of workers in these latter days, when we have to regret the loss of old hands which were active a quarter of a century ago, and have never been replaced. It seems to me that the condition of British Mycology, as far as earnest workers are concerned, is in much the same condition now as it was forty years ago, and there are scant hopes of revival. I observe, too, that the direction is somewhat different, for then it was centred in the larger fungi of the mushroom and toad-stool type, but now the strongest interest is in the parasites which

infest and destroy our crops, and thus compel attention to the invaders, not from choice, but from self interest.

The solving of puzzles in this branch of mycology has been proceeding gradually, but I think surely, in the past year. Professor Perceval's researches on "silver leaf" of fruit trees appears to be promising a successful issue. The causes affecting "club root" are engaging attention. The life history of many parasites are better elucidated, and faith in the use of fungicides gains strength day by day.

I should call your attention, as a practical matter, to the recent publication by my friend and pupil, Mr. George Massee, of a useful volume, entitled *European Fungus Flora, Agaricaceæ*, which replaces, as far as it goes, the *Clavis*, published some years ago, by myself, in conjunction with Dr. Quelet. The present volume includes only the Agaricaceæ, but it contains all the species hitherto known as occurring in Europe, with a special indication of those found in Britain. The *Clavis* included 1,943 species, of which 939 were given as British. The present work includes 2,750 species, of which 1,553 are British. The letterpress is in English, whereas that of the *Clavis* was in Latin. The descriptions, although compact, are longer and more complete than those of the *Clavis*, adding, in most cases, the dimensions of the spores. The classification is, for the most part, founded on that of Saccardo's *Sylloge*, and the construction of the work is evidently based upon the desire to make it a handy field book for the determination of species, as well as a compendium for home use. I can congratulate the author upon a successful achievement of his desire, and all mycologists who may be fortunate enough to possess it, of a valuable addition to the mycological literature of the year.

I also may be permitted, with some reserve, to refer to another publication, in which I am myself interested. Notwithstanding the valuable contributions to the subject of Plant Diseases by Mr. Massee and Professor Marshall Ward, it has long been felt that what is wanted in this country is a full enumeration of plant diseases of fungus origin, illustrated as much as possible by coloured figures, so as to assist the cultivator and the amateur. All efforts to secure a publisher for such a work having failed, the Royal Horticultural Society was appealed to, and ultimately arrangements have been made for issuing this

work consecutively in parts of the journal, the first part, with three coloured plates, including about eighty pests, appearing in the current part, just published. It is proposed to issue them in sections, as "Pests of the Flower Garden"; "Pests of the Vegetable Garden"; "Pests of the Orchard and Fruit Garden"; "Pests of the Vinery and Stove." Perhaps to be followed by "Pests of the Shrubbery"; "Pests of the Forest Trees"; and "Pests of Field Crops." Whether the attempt proves satisfactory or not, it will be some consolation to know that the effort is being made, and that it is contemplated to re-issue the entire series in book form, when the publication in the journal is completed; and that the second instalment of plates and letterpress are in the printer's hands.

III.—THE WORK OF THE FUTURE.

I may be asked what is, or what should be, the work of the future. And this I think should *not* be—as far as regards the Hymenomycetal Fungi—so much in the increase as in the diminution of the number of species. There are some people who measure success by the number of *new* species which are added to the lists during the year. But I am inclined to ask whether this is not rather a false success, somewhat of a deception, since we have not hitherto troubled ourselves enough to enquire what are the influences which are at work in the production of variation, in the Agarics for instance, and how far variation from a given type may proceed, under local influences, which would not justify specific distinction. I fancy when careful attention is given to this subject, we shall find our list of British species diminish considerably and justifiably, not at haphazard, but as the result of close and painstaking investigation. It is the young and inexperienced who are ever on the alert for new species, and the veterans who have wintered and summered half a century of field work that look with suspicion on the minute differences which are often considered sufficient to constitute a new species, without regard to the circumstances under which the type divergence occurred.

If I were to give an illustration of this, I should perhaps select two or three species which are not fair types of my meaning, but which would not be objected to on the ground that

they are good species, although at one time they were accepted as such. The Rev. M. J. Berkeley once described a fungus under the name of *Agaricus sadleri* which he considered to be a species of the subgenus *Clitocybe*, and was figured in the *Illustrations* as *Clitocybe sadleri* on plate 127. From the very first, I contended that this was only an abnormal form of *Hypholoma fascicularis*, and remonstrated with the venerable mycologist on that account, but he was so positive that I bowed to his judgment, as an older hand, and did not presume publicly to dispute his determination. In the type the gills are greenish grey, and the spores brownish, but in *sadleri* the gills are yellow and the spores, if spores are present, were colourless. Now this anomaly was found only once, under peculiar conditions, and is now universally acknowledged as a peculiar form of *Hypholoma fascicularis*.

The second illustration is an Agaric, which for many years I considered to be the true *Hypholoma lacrymabundus*, and it was figured under that name in *Illustrations* on plate 566. Berkeley always considered and taught that it was that species, and so it was regarded in this country for more than a quarter of a century, but at length Dr. Plowright was the first to call it in question, and demonstrate that it was only a variety of *Hypholoma velutina* with the hairs of the pileus tufted like scales. Although I remained stubborn as long as I could, the time came when I could resist no longer, but had to accept it as *Hypholoma velutina*, and admit my ignorance of the true *Hypholoma lacrymabunda*.

These two demonstrated errors will exhibit my meaning, and from this I might diverge, and point out twenty couples which I am disposed to regard as duplicates of the one species, but will forbear, until the evidence is stronger than mere suspicion. It will be work for the future to prove variation, subject to surrounding influences, in a number of so-called species. Meanwhile I may be permitted to make a suggestion or two. There is a *Russula* called *Russula rubra*, which is acrid to the taste, and reputed poisonous (fig. 1025), and there is another species which it would be quite impossible to distinguish from it by external features, called *Russula atropurpurea* (fig. 1087), and this is perfectly sweet and mild, and may be eaten with impunity. If these are not distinct species, what is the cause of the difference above indicated? Although I believe them to be one and the

same species, I want the evidence as to the cause of the difference.

Then again there are species (so-called) of *Lactarius*, respectively *camphoratus*, *cinicarius*, and *subumbonatus*, which I will not discuss, but I should like to see them compared and their differences put to the test, so that we may be certain that they only vary in submission to external circumstances.

There is another anomaly I want cleared up. There is a tawny *Russula* called *Russula fetens*, usually with a strong foetid odour, which justifies the name. But I have found the same species, to all external appearances, but without the foetid odour, and on the contrary pleasant, and rather fragrant. No doubt can rest upon the determination, because the size, colour, and peculiar striation of the margin of the pileus are characteristic. Who will solve the enigma.

I could go on for nearly an hour, with similar puzzles, but I have said enough to show that there is work for the future, in other directions beside the multiplication of species, even amongst the larger fungi.

But there is another field for work in the future which I would urge upon your notice. If you were to read the reports which have come over to this country during the past few years from America and the antipodes, as well as the complaints from our own fields and orchards, you would realize the enormous losses, not only in thousands, but in millions of pounds sterling every year by the destruction of crops by the incursions of insects and parasitic fungi. The determination of what Agarics are good to eat, and what to avoid, may appeal to the stomach, but this devastation by microscopic fungi appeals to the pocket, and that is a very strong appeal. The man who will thoroughly investigate the life history of one of these pests, and show how it may be successfully encountered and beaten, will be a benefactor to his race, and an ornament to his country. It may mean work, and plenty of it, but it will bring its own reward. I do not think that there ever has been a time when the fruit grower, the gardener, the practical horticulturist, and all concerned in the growth of flowers, fruits, vegetables, cereals, and even forest trees, were more anxious to secure the assistance and co-operation of the practical microscopist and vegetable pathologist than at the

present time. They are looking for help from science to assist them in their practical work. Whilst doctors are at work over microbes in their laboratories, in order to unveil the mysteries of human disease and alleviate human suffering, the vegetable pathologist should also be equally earnest in searching out the mysteries of plant diseases, so as to ease the mind and replenish the pockets of the cultivator.

MYCETOZOA OBSERVED AT THE FUNGUS FORAY, 1902.

By ARTHUR LISTER, F.R.S., F.L.S.

THE Field Club's ramble on October 18th did not yield so rich a harvest of Mycetozoa as on some previous occasion¹. The season has not been favourable for them, and only 12 species were obtained, viz. :—

Badhamia utricularis, Berk.

Physarum nutans, Pers.

„ *virnum*, Somn.

Fuligo septica, Gmelin.

Leocarpus vernicosus, Link.

Didymium nigripes, Fr.

Comatricha obtusata, Preuss.

„ *persoonii*, Rost.

Trichia varia, Pers.

„ *scabra*, Rost.

Arcyria punicea, Pers.

Lycogala miniatum, Pers.

Stereum hirsutum has spread in large patches on many of the felled hornbeams, and almost always where this was the case the plasmodium of *Badhamia utricularis* was advancing in orange-coloured veins, devouring the fungus²; the ripe fruit was only found in two or three instances. The other Mycetozoa met with were common species, and need no comment.

¹ Consult Mr. Lister's paper "Practical Hints on the Study of the Mycetozoa, with notes on the Epping Forest species," in *ESSEX NAT.*, vol. x., pp. 23-27.—Ed.

² See note on plasmodia stage of *Badhamia* in *Journal of Proceedings E.F.C.*, vol. iv. p. clxxiii.

THE NON-MARINE MOLLUSCA OF THE RIVER LEA ALLUVIUM AT WALTHAMSTOW, ESSEX.

By A. S. KENNARD, M. Malac. Soc., and B. B. WOODWARD, F.L.S., F.G.S.

[Read December 6th, 1902.]

THE extensive excavations for new reservoirs for the East London Water Company that have lately been made in the Lea Valley, near Walthamstow, furnished a magnificent opportunity for collecting from the Holocene deposits, which are only exposed in chance excavations. Application was made to the contractors, Messrs. S. Pearson and Sons, for permission to visit the works, and this was at once granted. We would take this opportunity of thanking them and the following gentlemen

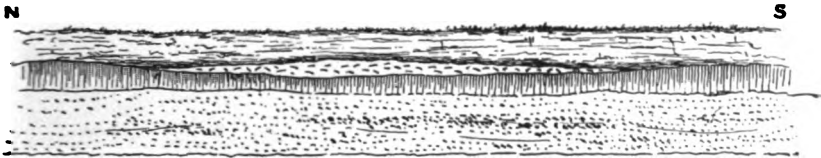


FIG. 1.—SECTION IN NEW RESERVOIRS, WALTHAMSTOW, ABOUT 100 YARDS.

Showing lenticular bed of Shell-marl resting on Peat, and covered by the Clay forming the surface. Gravel at the base. (T. V. Holmes.)

for facilities in visiting the sections, and for other assistance :— Mr. W. Cole, Mr. W. Whitaker, F.R.S., Mr. C. W. Sharrock, Colonel Bryan, Mr. J. P. Johnson, and especially Mr. W. Traill. Repeated visits have been made, and an immense amount of material has passed through our hands. The sections have already been described by Mr. T. V. Holmes,¹ and as may be seen by reference to this paper, a twofold division of the beds is always present, an upper peaty or loamy bed sometimes containing Shell-marl and a lower bed of Gravel.

The gravel contained no fossils except where it was obviously re-deposited. There can be no doubt that the peaty beds, which varied from 3 to 10 feet in thickness, represent the whole of the Holocene deposits, and are the equivalent of the 60 feet of alluvium met with in the Thames valley at Tilbury, whilst the bottom gravel may be correlated with the third terrace of the

¹ Consult "Geological Notes on the New Reservoirs in the Valley of the Lea, near Walthamstow," *E.N.* Vol. XII., pp. 1-16, and "Additional Notes" on the same in *E.N.* Vol. XII., pp., 224-231.

Thames, which is generally considered to represent a late stage of the Pleistocene. The section here given (Fig. 1) may be taken as a typical one. Here the division of the upper bed into loamy-clay and peat is well shewn.

In our opinion the peat represents the deposit accumulated in the valley before any reclamation had taken place, whilst the loamy-clay has been deposited by flood-water since man had altered the original condition by embankments and other works. Knowing only too well by past experience the difficulties arising from the shifting of the course of a stream, our work was principally confined to the parts away from the influence of the main stream. It should, however, be borne in mind that the modern deposits of the River Lea, caused by erosion and subsequent deposition, differed lithologically from the older beds, for the former in all cases consisted of sand or sandy gravel with but little vegetable remains, so that there was never any difficulty in dealing with such cases. It must also be noted that when a stream washes away an old deposit, many of the shells, though apparently fragile, will be drifted down and safely deposited elsewhere, so that the new bed would contain the shells living at the time of deposition mixed with those derived from older beds. That the age of some patches of the shell marl dates back to Neolithic times is evident from the discovery of Neolithic flakes *in situ* under such conditions that they can only have been dropped where now found from the hand of man. In 1897*, we gave to the Essex Field Club an account of the Mollusca from these beds, yet the new facts accumulated are of so much importance as to justify the production of this additional paper.

MOLLUSCA OF THE MODERN DEPOSITS.

The following species were obtained from the loamy-clay :—

<i>Vitrea nitidula</i> (Drap.)	<i>Linnaea pereger</i> (Müll.)
<i>Hygromia hispida</i> (Linn.)	„ <i>truncatula</i> (Müll.)
<i>Vallonia pulchella</i> (Müll.)	<i>Planorbis marginatus</i> , Drap.
<i>Helicigona arbustorum</i> (Linn.)	„ <i>vortex</i> (Linn.)
<i>Helix nemoralis</i> , Linn.	„ <i>spirorbis</i> , Müll.
<i>Cochlicopa lubrica</i> (Müll.)	<i>Bithynia tentaculata</i> , Linn.
<i>Pupa muscorum</i> (Linn.)	„ <i>leachii</i> (Shepp.)
<i>Succinea elegans</i> , Risso.	

* KENNARD A. S., and WOODWARD, B. B. The Post-Pliocene Non-marine Mollusca of Essex. ESSEX NAT., vol. x., pp. 87-109.

The band formulæ of the examples of *Helix nemoralis* are :—

1 2 3 (4 5), 6 examples.
 (1 2 3) (4 5), 5 „
 1 2 3 4 5, 4 „
 (1 2) 3 (4 5), 1 example.
 0 0 0 0 0, 1 „

In the Lockwood reservoir at one spot close to the main stream was a sandy deposit, obviously quite modern, containing a large number of non-marine shells, as well as examples of *Ostrea edulis* and *Buccinum undatum*. We were informed by Mr. Traill that a mill formerly stood near this spot. The species found are thirty-six in number, viz :—

<i>Pyramidula rotundata</i> (Müll.)	<i>Planorbis marginatus</i> , Drap.
<i>Helicella cantiana</i> (Müll.)	„ <i>nautileus</i> (Linn.)
<i>Hygromia hispida</i> (Linn.)	„ <i>vortex</i> (Linn.)
<i>Vallonia pulchella</i> (Müll.)	„ <i>contortus</i> (Linn.)
<i>Helicigona arbustorum</i> (Linn.)	<i>Physa fontinalis</i> (Linn.)
<i>Helix nemoralis</i> , Linn.	<i>Bithynia tentaculata</i> (Linn.)
<i>Succinea putris</i> (Linn.)	„ <i>leachii</i> (Shepp.)
„ <i>elegans</i> , Risso.	<i>Vivipara vivipara</i> (Linn.)
<i>Ancylus fluviatilis</i> (Müll.)	<i>Valvata piscinalis</i> (Müll.)
<i>Limnæa pereger</i> (Müll.)	<i>Neritina fluviatilis</i> (Linn.)
„ <i>auricularia</i> (Linn.)	<i>Unio tumidus</i> , Retz.
„ <i>truncatula</i> (Müll.)	„ <i>pictorum</i> (Linn.)
„ <i>palustris</i> (Müll.)	<i>Anodonta cygnæa</i> (Linn.)
„ <i>stagnalis</i> (Linn.)	<i>Sphærium rivicola</i> (Leach.)
<i>Planorbis corneus</i> (Linn.)	„ <i>corneum</i> (Linn.)
„ <i>albus</i> , Müll.	„ <i>lacustre</i> (Müll.)
„ <i>stroemii</i> , West.	<i>Pisidium amnicum</i> (Müll.)
„ <i>carinatus</i> (Müll.)	„ <i>supinum</i> (A. Schm.)

The band formulæ of the examples of *Helix nemoralis* are :—

1 2 3 (4 5), 1 example.
 1 (2 3) (4 5), 1 „
 (1 2) 3 4 5, 1 „
 (1 2) 3 (4 5), 1 „
 1 2 3 4 5, 5 examples.

Many other samples of modern deposits from other spots were examined, but they yielded no fresh species.

As we have already stated, far more attention was paid to the Shell-marl than to the other deposits. The patches varied in

size and in their composition. Occasionally all traces of mollusca had vanished, whilst in others only a few still remained; but as a rule they were very abundant and well preserved. Many were coated with calcareous matter, completely covering the shell. This condition is also met with in some of the Irish lakes where the dead shells are drifted ashore. It is also found in the Holocene deposits of the Thames, and in the Pleistocene High Terrace Gravel at Swanscomb, Kent. It has been suggested that the primary cause of this incrustation may be the coating of algoid growth that invested the test during the life of the animal. As a rule, more aquatic forms were present in these marls than terrestrial, although occasionally the reverse condition prevailed. We obtained 66 species, of which 18 have not hitherto been recorded from these beds, whilst four, before observed, were not found by us :—

LIST OF SHELLS FROM SHELL-MARL.

<i>Agriolimax agrestis</i> (Linn.)	<i>Vertigo pygmæa</i> (Drap.)
<i>Vitrea crystallina</i> (Müll.)	<i>Balea perversa</i> (Linn.)
„ <i>alliararia</i> (Müller)	<i>Clausilia laminata</i> (Mont)
„ <i>cellaria</i> (Müll.)	„ <i>bidentata</i> (Ström)
„ <i>nitidula</i> (Drap.)	„ <i>putris</i> (Linn.)
„ <i>radiatula</i> (Alder)	<i>Succinea elegans</i> , Risso.
„ <i>nitida</i> (Müll.)	<i>Carychium minimum</i> , Müll.
„ <i>fulva</i> (Müll.)	<i>Ancylus fluviatilis</i> (Müll.)
<i>Arion ater</i> (Linn.)	<i>Velletia lacustris</i> (Müll.)
<i>Punctum pygmæum</i> (Drap.)	<i>Limnæa auricularia</i> (Linn.)
<i>Pyramidula rotundata</i> (Müll.)	„ <i>pereger</i> (Müll.)
<i>Hygromia granulata</i> (Alder)	„ <i>palustris</i> (Müll.)
„ <i>hispida</i> (Linn.)	„ <i>truncatula</i> (Müll.)
<i>Vallonia pulchella</i> (Müll.)	„ <i>stagnalis</i> (Linn.)
<i>Helicigona lapicida</i> (Linn.)	<i>Planorbis corneus</i> (Linn.)
„ <i>arbutorum</i> (Linn.)	„ <i>albus</i> , Müll.
<i>Helix aspersa</i> , Müll.	„ <i>stræmii</i> , West.
„ <i>nemoralis</i> , Linn.	„ <i>nautilus</i> (Linn.)
„ <i>hortensis</i> , Müll.	„ <i>carinatus</i> , Müll.
<i>Cochlicopa lubrica</i> (Müll.)	„ <i>marginatus</i> , Drap.
<i>Pupa muscorum</i> (Linn.)	„ <i>vortex</i> (Linn.)
<i>Vertigo antivertigo</i> (Drap.)	„ <i>spirorbis</i> , Müll.

<i>Planorbis contortus</i> (Linn.)	<i>Anodonta cygnæa</i> (Linn.)
„ <i>fontanus</i> (Lightft.)	<i>Sphærium corneum</i> (Linn.)
<i>Physa fontinalis</i> (Linn.)	<i>Pisidium amnicum</i> (Linn.)
„ <i>hypnorum</i> (Linn.)	„ <i>supinum</i> , A. Schm.
<i>Bithynia tentaculata</i> (Linn.)	„ <i>henslowianum</i> (Shepp.)
„ <i>leachii</i> (Shepp.)	„ <i>subtruncatum</i> , Malm.
<i>Vivipara vivipara</i> (Linn.)	„ <i>pulchellum</i> , Jenyns.
<i>Valvata piscinalis</i> (Müll.)	„ <i>pusillum</i> (Gmel.)
„ <i>cristata</i> , Müll.	„ <i>nitidum</i> , Jenyns.
<i>Neritina fluviatilis</i> (Linn.)	„ <i>obtusale</i> , Pfr.
<i>Unio tumidus</i> , Retz.	„ <i>milius</i> , Held.

The following species, previously recorded from these beds, we did not find :—

<i>Acanthinula lamellata</i> (Jeff.)	<i>Vivipara contecta</i> (Millet)
<i>Helicella caeperata</i> (Mont.)	<i>Unio pictorum</i> (Linn.)

NOTES ON THE SPECIES.

Arion ater (Linn.). Several calcareous granules representing the internal shell of this species were found. It has not hitherto been detected in these, or in any other Holocene deposit in Essex, though it is known from the Pleistocene of Ilford.

Of the ten species of *Vitrea* living in this country, all but three were met with, the exceptions being *V. pura* and "*glabra*" and *V. excavata*. *V. alliaria* is represented by a single example, and is of considerable interest, since it has hitherto been only known fossil in these islands from the Pleistocene of Ightham and Happaway Cavern. *V. nitidula* was very common and is separable into two forms, a larger one attaining a maximum diameter of 11 mm., and a smaller one of only 6.5 mm. The latter is known on the Continent under the name of *V. nitens* (Mich.).

Agriolimax agrestis (Linn) was represented by eight examples. Only a single specimen has hitherto been obtained from these beds.

Punctum pygmaeum (Drap) has not previously been recorded from the Lea alluvium and now but a solitary example establishes its presence.

Hygromia granulata (Alder) is another new record for these beds; but, although several specimens were found, all are immature.

Hygromia hispida (Linn) was by far the commonest Helicoid present, but the examples are by no means large, the finest being but 9 mm. in diameter, the average height being 5.5 mm.

Helicigona lapicida (Linn) was not common, and all the examples found were obtained from one patch of shell-marl near the south side of the Lockwood Reservoir. It is a new discovery for this neighbourhood, though it has been known from the alluvium of the Lea at Canning Town.

Helicigona arbustorum (Linn) was an extremely common form, and varied much in shape and size, the largest example being 18 mm. in height, and 20 mm. in diameter, whilst the smallest was 13 mm. in height and 16 mm. in diameter.

Helix aspersa, Müll, was answered for by two examples, both very small, being 25 mm. and 24 mm. in height and 26 mm. and 27 mm. in diameter.

Helix nemoralis, Linn, was very common, the shells being often well preserved, and still retaining their coloration.

The band formulæ noted were :—

1 2 3 4 5,	252 examples	(1 2) 3 (4 5),	2 examples
1 2 5 (4 5),	54 "	0 0 3 0 0,	14 "
(1 2 3)(4 5),	31 "	1 (2 3 4 5),	5 "
(1 2 3 4 5),	37 "	0 0 3 4 5,	2 "
1 (2 3)(4 5),	8 "	0 2 3 4 5,	1 example
1 0 3 4 5,	3 "	1 (2 3) 4 5,	1 "
0 0 0 0 0,	34 "	1 2 (3 4 5),	1 "

It will be noticed that the banded examples are greatly in excess of the unicolorous examples, and that there is a marked tendency for the bands to coalesce, a condition probably arising from some condition in the environment.

Helix hortensis, Müll, was a new record for these beds. The band formulæ observed were :—

1 2 3 4 5,	12 examples.
0 0 0 0 0,	3 "
1 (2 3) 4 5,	1 example.
1 (2 3 4 5),	1 "

Balea perversa (Linn). One single example constituted an interesting addition to the fauna of the alluvium of the Lea. The species is extremely rare in the fossil state, being only known

from the Pleistocene of Barnwell and the Holocene of Exedown (near Wrotham), Crossness and the Hampshire tufaceous deposits.

Clausilia bidentata, Ström. This widely distributed form has hitherto been undetected in these beds. It was represented by six examples.

Succinea elegans, Risso, proved a more abundant form than *S. putris*, Linn. One example of the former, the largest we have seen, measured no less than 21 mm. in length. The largest individual of *S. putris* was 18.5 mm. in length, the average size being 12.5 mm., whilst the average of *S. elegans* is rather less.

Carychium minimum, Müll., was not common, but it is a new record.

Limnæa auricularia, Linn, on the other hand was very abundant, many of the examples attaining a large size, but the finest of all were obtained from the modern deposits.

Limnæa pereger, Müll., was equally common with the last-named in the older beds, but was decidedly scarce in the more recent deposits.

Limnæa stagnalis, Linn., attained a large size, and was not uncommon. The largest individual measured 52 mm. in height, with a maximum breadth of 22 mm.

Limnæa truncatula, Müll., was another common form, and was decidedly above the average in size.

With the exception of *Planorbis glaber*, Jeff., and *P. lineatus*, Walker, all the British species of *Planorbis* were present. It was the material from these beds that first enabled us to differentiate the form *P. stroemii*, West, which had not hitherto been noted in these islands, either living or fossil.*

The species is near to *P. albus* Müll, but is distinguished from it by its larger size, the constant presence of a keel, and the absence of spiral striæ: it also resembles an almost keelless variety of *P. carinatus*.

At Walthamstow *P. stroemii* was a far more abundant form than *P. albus* in the older beds, but in the modern deposits the former is very scarce, whilst the latter is abundant. In our opinion the examples in the recent beds have been derived from older deposits. Mr. A. C. Johansen, of the Zoological Museum,

2 *Proc Malacological Soc. Lond.* Vol. IV. (1901), p. 236.

Copenhagen, who kindly identified the species for us, informs us that it is now living in Siberia, Finland, and Northern Scandinavia, while it occurred in Denmark solely in deposits of the Oak-period (= Bronze-age). Up to the present we have noted it from the dried "Thames mud" of the Embankment on the site of the New Scotland Yard (in which it is probably a derived fossil), from the Holocene gravels at the same spot and at the Houses of Parliament; from Betteridge Road, Fulham; Kew, Staines, and Clifton Hampden, Oxfordshire. It will be noted that these are all connected with the Thames river system. Why a form, which was abundant within comparatively modern times, should have become totally extinct, is indeed an interesting problem, for which we can offer no solution. (Fig. 2.)

Planorbis fontanus, Lightft., forms another new record for these beds.

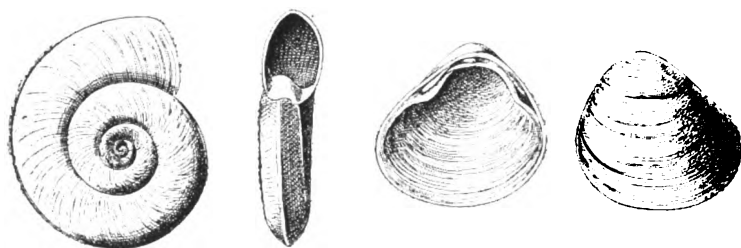


FIG. 2. *PLANORBIS STROOMII*, WEST. 3.
FIG. 3. *PISIDIUM SUPINUM*, A. SCHM.
Both magnified four diameters.

No less than 9 species of **Pisidium** were obtained, of which the most noteworthy is **P. supinum**, A. Schmidt, a form which has hitherto been undetected in these islands. For its identification we are again indebted to Mr. A. C. Johansen. The examples are large, but are by no means so fine as those which occur in the Pleistocene of Grays. We are of opinion that this form will eventually be found to have been widely distributed in England during Pleistocene and Holocene times, though as yet it has not been detected living. (Fig. 3.)

CONCLUSIONS.

We have now a list of 73 species of Mollusca from the Alluvium of the River Lea, 70 coming from the older

beds, and 3 from the modern deposits. These last are :—

Helicella cantiana (Mont.)

Sphærium rivicola, Leach.

——— *lacustre* (Müll.)

The first-named must be considered a recent introduction, because though widely distributed over Essex at the present time, it has not hitherto been found fossil in any deposit in the country, however modern, and the available evidence seems to show that it was introduced at a later period. *Sphærium rivicola*, on the other hand, is known from both the Pleistocene and Holocene. Its absence from the Shell-marl is probably accidental, and the same may be said of *Sphærium lacustre*. The four species which were not identified by us in these recent excavations are :—

Acanthinula lamellata (Jeff.) *Vivipara contecta* (Millet.)

Helicella caperata (Mont.) *Unio pictorum* (Linn.)

The last-named was to be seen in the modern beds, but not in the older deposits.

We have already noted two species, *Planorbis stræmii*, West. and *Pisidium supinum*, A. Schm, as being quite extinct in this county, though common in these deposits, but the remaining 64 species are all living in the area drained by the River Lea. One thing is noteworthy, and that is the almost total absence of abnormal or monstrous forms, with the exception of *Planorbis stræmii*. This form is very often slightly distorted. There were a few "mended" examples of *Helix nemoralis* and *Helicigona arbustorum*; two slightly scalariform specimens of *Bithynia tentaculata* and one of *Limnæa palustris*; two distorted examples of *Planorbis spirorbis* and three of *P. vortex*. These are all observed, although we have had many thousands of shells through our hands.

A great advance has been made in our knowledge of these beds in the last few years. In 1890 only 40 species were known as occurring in them. In 1897 we were able to list 52, and now the record stands at 70, or if we include the forms from the modern deposits, at 73. Fresh excavations will no doubt add to the list, since there are many forms living in the Lea Valley which are unknown from these beds. We would urge all members of the Essex Field Club to lose no opportunity of collecting from any future exposure in the Lea alluvium.

**NOTES ON THE SPIDERS OBSERVED AT
THE MEETING IN EPPING FOREST,
JULY 26th, 1902.**

By FRANK P. SMITH.

ON this ramble the following species were listed, the localities being Epping Thicks, Ambresbury Banks, and Honey Lane Quarters :—

Harpactes hombergii.

Clubiona terrestris.

Clubiona diversa ♀. First record for the Forest.

Tegenaria atrica. This species is not uncommon in the Forest, spinning an extensive sheet of web behind which is a tubular opening leading to a usually very secure retreat.

Agelena labyrinthica. Common in the ditches by the side of the Epping Road. I have never seen specimens in positions so exposed to the fingers of the araneologist. The sheet-like snares are usually placed amongst rank herbages, often amongst brambles or furze, and the occupants are thus well protected. In the present instance the webs were greatly exposed and the tubular retreat very short, leading simply to slight holes in the muddy sides of the ditch.

Pisaura mirabilis. Females were found with egg-sacs and also with newly-hatched families. The egg sac, which is globular, is carried about by means of the falces and palpi; and after a time it is deposited upon the top of some slender plant (often a fern) where it is shrouded in a kind of silken cage of considerable dimensions (often 3 inches in diameter). Here the young are hatched, the female being usually found in the immediate vicinity carefully watching her charge.

Lycosa lugubris. Females also of this species were found, some with egg-sacs and others with families. The egg-sacs, lenticular in shape, are attached to the spinners; and the young when hatched cling to the body of the mother, scattering if disturbed, but re-congregating as soon as the danger has passed away.

Hasarius falcatus, ♂ and ♀. A pretty "jumping-spider," not uncommon on heather.

Ballus depressus. A rather rare species, of which several specimens have been found in the Forest, and a couple of females upon the walls of the East London Water Works, Lea Bridge.

Theridion formosum. One of the most beautiful and striking of our indigenous spiders. It varies greatly in point of colour, but may be easily recognised by the excessive elevation of its abdomen, which might be almost termed subconical. The snare is very extensive and is usually stretched between the trunk of a tree and a thick bough, almost invariably below the latter. The pale brown egg-sacs, several in number, are hidden in a few fragments of dead leaves, or a single rolled leaf, placed in the centre of the snare. The spider falls at once when disturbed and "feigns death" with great tenacity.

Phyllonethis lineata. A delicate yellowish or greenish white little spider, often ornamented with scarlet abdominal hands.

Microneta viaria, ♂. A rare species. I had previously taken only the female in the Forest.

Erigone dentipalpis. A common species on grass lands.

Aranea cucurbitina. A beautiful spider with reddish thorax and green abdomen.

Numerous immature specimens of *Philodromus*, *Linyphia*, *Tetragnatha*, *Aranea*, etc., were also found.

FURTHER ADDITIONS TO EPPING FOREST.

SINCE our last paper on this subject (E.N., Vol. XI., pp. 268-70) several important increments to the open lands have been reported by the Epping Forest Committee.

The arrangement with Mr. Melles, whereby in exchange for certain way leaves, 13 acres adjoining the Yardley Hill estate, Sewardstone, were conveyed to the Conservators without payment (*l.c.* p. 268), has now been carried out, and all will admit

¹ See note on this habit in the last volume (Vol. XII. p. 108).

that this is a valuable addition to the forest. It "rounds off" Mr. Buxton's gift of Yardley Hill in a most satisfactory manner, and brings that land into full sweep with the north-western corner of Bury Wood.

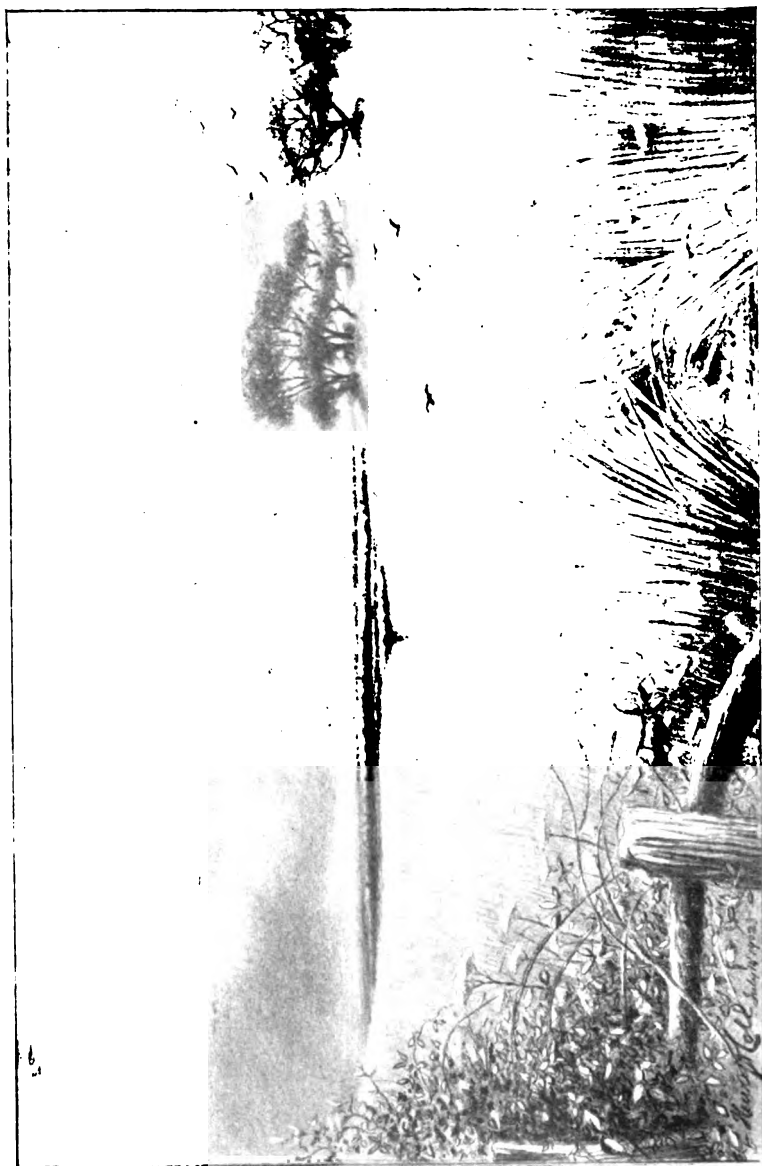
Mr. Peter Gallatly, one of the Verderers of the forest, has made a voluntary conveyance of a piece of freehold with a cottage upon it, situate in the Fairmead, Loughton, and entirely surrounded by forest land. This sinks one of the "islands" referred to by Sir Fowell Buxton as being motes on the fair face of the forest.

In the report presented on the 15th January, 1903, the Committee said:—

"On the 13th March last your Honourable Court referred to us to take such steps as might be necessary with regard to the offer by Gerald Buxton, Esq., the Lord of the Manor of Theydon Bois, to present to the Corporation the greater part of Bell Common, near Epping, and the waste land along Ivy Chimneys Road. So much of the Common as is situated in Epping was acquired by the Corporation in 1876, but the remainder, singularly enough, was outside the ancient boundary of the Forest, although unenclosed, and after the Forest was vested in the Conservators several abortive attempts were made to purchase from the then Lord of the Manor the portion in Theydon Bois, containing 7 acres 0 roods 11 perches. Mr. Gerald Buxton, however, generously offered to convey the land, together with some roadside wastes in Ivy Chimneys Road, containing 0 acres 3 roods 34 perches to the Conservators. We instructed Mr. Solicitor to complete the matter, and the land has been conveyed accordingly, and forms a valuable addition to the Forest.

"The Belle Vue Estate, Walthamstow, adjoining Walthamstow Forest, has recently been developed as a building estate, and as the Eastern boundary abutting on the Forest was very irregular, the owner of the estate proposed a give-and-take line. After we had viewed the property, negotiations took place, and an arrangement was made by which the owners of the estate conveyed to the Conservators a piece of woodland, containing 1 acre 1 rood 33 perches, in exchange for the forest land thrown into the public way, containing 3 roods."

Several other matters are referred to in the last three years' reports, such as the enlargement of the Hollow Pond, Leytonstone, at an estimated cost of £1,800, towards which Mr. E. N. Buxton contributed £300, the Urban District Council of Walthamstow £300, out of the Epping Forest Fund £600, and the remainder from the Corporation Funds. The pond at Chingford, near Queen Elizabeth's Lodge, has been cleansed and deepened, and the same operation has been performed at the Higham Park Lake. A new entrance to Wanstead Park from the Ilford Recreation Ground by a road and a rustic bridge over the Roding



VIEW OVER FOXBOROUGH FARM, FROM CABIN PLAIN.

Pencil Drawing by H. A. Conk, July 14th, 1902.

has been made by the Urban Council by permission of the Conservators. Sir Edwin Durning-Lawrence, Bart., M.P., has erected a handsome granite drinking-fountain near the Lodge at Chingford. Finally, the old Tapestry in Queen Elizabeth's Lodge, has been restored by the expert, M. Brignolas, at a cost of £132 3s., and the renovated pieces have been placed in prominent positions in the Museum.

The Forest is evidently making rapid progress, and a new official map will soon be necessary to register the valuable accretions and improvements of recent years.

A NEW FOREST OF WALTHAM.

PRELIMINARY NOTICE.

(With Plates I., II., and III.)

POLITICAL Economy has been called the "dismal science," and the pseudo-"scientific" views which prevailed on social subjects in the dark ages of the middle of the last century well justified the phrase. To sacrifice the nation's most precious heritage of shady woods and breezy commons for the sake of a few thousand pounds added to the Queen's Exchequer, or to satisfy the restless craving for unallotted acres of avaricious neighbouring landowners, were proceedings lauded by professors of economics as gains worthy of long years of Enclosure Acts and landlord-created Commissions. To these erroneous views of a people's true wealth and happiness, we owe the most regretful of all the 19th Century enclosures, that of the beautiful division of Waltham Forest known as Hainhault.

The disafforestation of Hainhault was accomplished by an Act of Parliament passed in 1851. The legal "forest" then consisted of 17,450 acres, of which about 4,000 acres were unenclosed and subjects to rights of common; 2,900 acres of the said 4,000 were called King's Woods, in which the Crown had the right of the soil and timber. Under a subsequent Act (1858) the Assistant Commissioner allotted 1,877 acres to form commons for the parishes of Barking, Dagenham, Stapleford Abbots, Lambourne, Chigwell, Woodford, and Navestock.

It will be thus seen that although the action of the ill-advisers of the Crown was bad enough, they had some saving

grace and a desire to benefit the poor cottagers by a not illiberal allotment of commons. The manorial landlords had no such scruples ; they aimed to "convey" (to use Ancient Pistol's word) the whole remaining open lands. The division of the "Forest" into parish commons having been made, the supineness of the people and a compliant Parliament made the rest easy, and six of the seven commons carved out of the old woodlands, were "acquired" within a very few years. As Sir Robert Hunter says, "in order to abolish the common thus left, and to reduce the whole parish to the much desired condition of private land, but one more step was necessary—an enclosure carried out under ordinary conditions. By the aid of the Enclosure Commissioners, every parish common save one was cut up and allotted among the lord of the manor and the landowners, and the destruction of the ancient forest was at last complete. Happily there was one exception. The Lord of the Manor of Lambourne, father we believe of the present Colonel Mark Lockwood, member for the Epping Division of Essex, does not appear to have suffered from the prevalent rage for converting woods, commons and pastures into arable land. He did not apply for an enclosure of the Lambourne parish allotment ; and it remains, a bit of old Hainhault Forest, to the present day."

The King's Wood lands allotted to the Crown comprised 1,873 acres. The whole of the timber was cleared off, the stumps dragged out, and most of the land put under the plough ; in place of a beautiful woodland there appeared a barren looking, meagre, and somewhat unprofitable farm—and so the ancient glories of Hainhault remained eclipsed for 50 years.

It is not proposed in the present short article to recount the ancient history of this portion of Waltham Forest, or to give any description of its scenery and former natural productions ; this is reserved for future papers, in which also we hope to review the botany and general natural history of those portions still retaining a forestal character. We have simply to recount the present stages of a noble scheme of reclamation for public uses and enjoyment of the existing woodlands, and of gradual re-afforestation (in the non-legal sense, of course) of portions of the "King's Wood" lands.

The thought that so much of the land remained in the possession of the Crown has often tempted lovers of open spaces

to dream of a recreated Hainhault, possibly in connection with a Government School of Forestry. The enthusiasm and determined purpose of Mr. E. N. Buxton were needed to "materialise" the dream and to bring the problem of the re-afforestation of Hainhault within the sphere of practical social politics.

The remnants of Hainhault, still in a more or less forestal condition, included in Mr. Buxton's scheme, are five in number, and are of very varying extent. The most important is called "Lambourne Forest," which, as above mentioned, was not enclosed, the manorial privileges remaining with Colonel Lockwood, and the forest is still subject to common rights. This block is about 188 acres in extent, and is a charming piece of woodland, similar to parts of Epping Forest. It is most valuable and interesting, inasmuch as it affords a picture of what old Hainhault must have been in the days of its beauty (*Plates I. and III.*). Adjoining this are three portions of the old forest, comprising 14 acres of common, and two plots of enclosed land, 52 acres and 22 acres respectively, much of which is still well timbered. All these lands are contiguous, but the fifth forestal section is far away towards Woodford Bridge, and is known as Grange Hill Forest, about 80 acres. It is very pretty woodland, part of the untouched old forest, and is therefore a most desirable acquisition. But it constitutes a distinct feature in the scheme, and will probably be under separate control, as hinted below.

The cleared land includes 52 acres of the old forest, which was set out under the Allotment Award as a Common for the parish of Lambourne, but which has been for many years under cultivation. It lies on the slope of a hill, commanding extensive views over the adjoining country. And lastly comes what is, perhaps, the most remarkable item in Mr. Buxton's scheme. It is a block of land known as Fox Burrows Farm, comprising no less than 475 acres of arable land (*Plate II.*). This forms part of the Crown assignments under the original Act of Enclosure, and the Commissioners of His Majesty's Woods and Forests are willing to sell the land at agricultural value, provided it is dedicated to the public as an open space. It is high rolling ground, rising in parts to 300 above O.D., and its hill-sides fall in gentle overlapping lines. "From its higher ground the eye ranges

westwards to the wooded ridges of Epping Forest, eastwards over the hedge-row elms of Essex, and southwards across the Valley of the Thames."

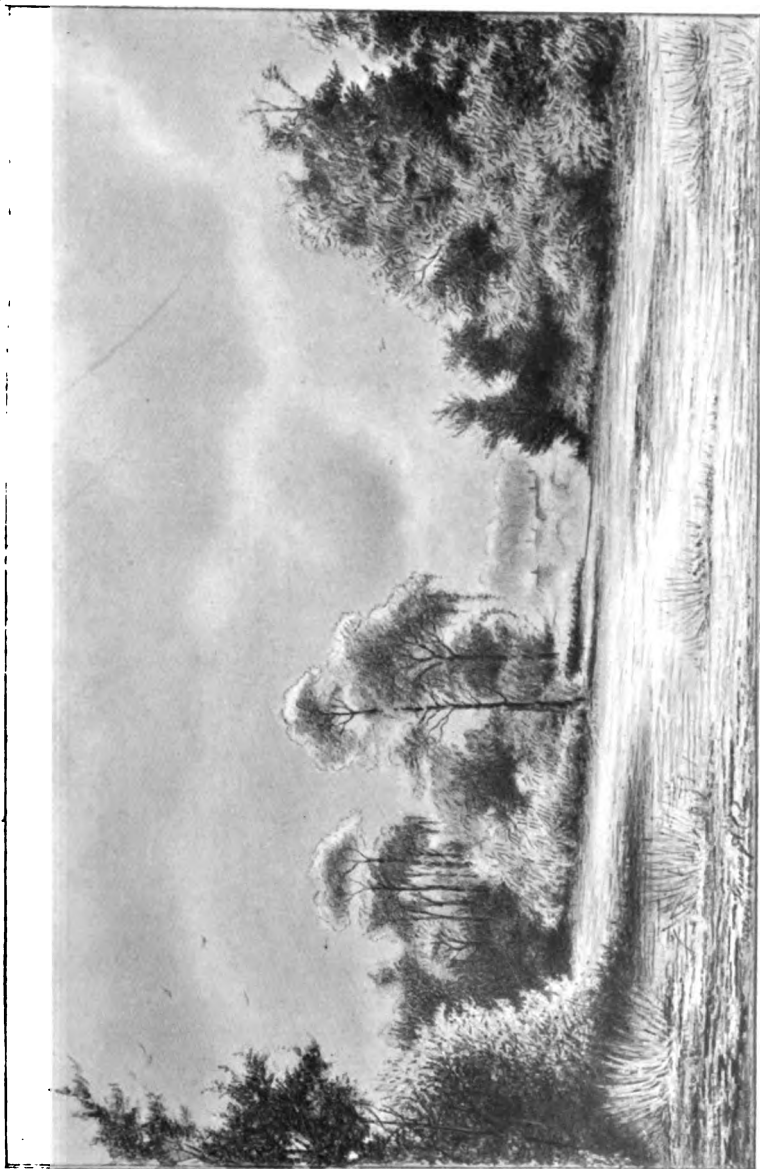
From the above sketch it will be gathered that the re-created Hainhault would comprise :—

	Acres.
Lambourne Forest	188
Chigwell Manor Land, 14 + 52 + 22	88
Lambourne Common	52
Fox Burrow Farm	475
	<hr/>
	803
Grange Hill Forest	80
	<hr/>
	883

To secure the option of purchase of these lands and manorial claims Mr. Buxton has had to conduct *five* separate negotiations. The estimated cost of the main blocks, Lambourne and Hainhault, is about £22,000, and of Grange Hill, £9,000.

In considering ways and means of purchase, Mr. Buxton has separated the Lambourne and Hainhault blocks from the Grange Hill portion. Towards the main scheme about £2,500 has been privately subscribed, while the Essex County Council, the Corporation of West Ham, and the district Councils of Leyton, Wanstead, and Ilford, have passed resolutions agreeing to contribute. To the surprise and regret of their own Epping Forest Committee as well as of the general public, the Corporation of London declined to contribute or to take part in the scheme. Application was then made to the London County Council, and that body has agreed to contribute £10,000, and to accept and manage the land as an open space for the benefit of the public. Several details yet remain to be settled, and to avoid certain legal difficulties with regard to the contributions from local authorities, Mr. Buxton has promoted a Bill in Parliament to authorise the acquisition of the lands. The conduct of this Bill will be taken over by the London County Council.

Considerable progress has been made towards the acquisition of the Grange Hill portion of the scheme, but until the various difficult negotiations in connection with it are finally settled, it will be best to defer details. If the London County Council decline to take the land over, it is hoped that some plan of local control may be arranged. This bit of forest appears always to have lain apart from the main Hainhault Woods; under the Acts



CABIN PLAIN, HAINHAULT FOREST.

Pencil Drawing by H. A. Cole, July 14th, 1902.

it came into the possession of the Lord of Chigwell Manor, and was of course enclosed. Its trees and undergrowth, however, remain, and it is a beautiful example of the old natural woodland. The price, £9,000, although much higher proportionately than the rest of Mr. Buxton's proposed purchases, is very small for land so much nearer the railway, and its acquisition as a permanent open space is a matter of great importance and urgency.

Should Mr. Buxton's efforts prove successful, and of this there is now no reasonable doubt, the re-forestation of Hainault will rank as the greatest scheme of "open-spacing" (with the exception of Epping Forest) ever carried out near London; it is a matter of truly national magnitude and interest. The growth of London within the last 30 years is one of the most serious social questions of the age—the parishes lying only a few miles from the "New Waltham Forest" have increased in population by 600,000 inhabitants.

When the land is safely secured, doubtless Mr. Buxton's idea that, as far as possible, nature should be allowed full sway, will be intelligently followed. The various problems of sowing and planting are even now exciting discussion among foresters and arboriculturalists; the possibilities from the naturalist's point of view are almost infinite, and the gradual upgrowth of a "reserve" within 12 miles of London will present a fascinating field for study.

But all these considerations must form subjects for future papers. In a few months time we may hope that all legal and financial difficulties will have been surmounted. It will then be possible to give a map and the precise area of this noble addition to our open spaces. The examination of the present natural condition of the various lands, the fauna and flora of the districts, will afford much work for observers for many years to come, while the changes brought about by the re-forestation must be carefully noted from year to year.

The three plates drawn by Mr. H. A. Cole for this first notice will give some idea of the nature of the ground, and in the future we shall hope to present a series of sketches which will have permanent value a generation hence, when the district re-asserts its claim to be considered a part of the still noble remnant of the great Forest of Waltham.

THE ESSEX FIELD CLUB: REPORTS OF MEETINGS.

IN SUPPORT OF THE SCHEME FOR THE RE-AFFORESTATION OF PART OF OLD HAINHAULT FOREST.

SATURDAY, JUNE 14TH, 1902.

THE details of Mr. Buxton's grand movement and its present position are dealt with in a separate article.

On this day a meeting, organised by the Club at Mr. Buxton's request, was held for a public inspection of the woods and lands proposed to be re-afforested in Lambourne and Hainhault forests.

A very large number of invitations had been sent to members of the Essex County Council, the West Ham Town Council, and the Councils of Barking, Ilford, Woodford, Buckhurst Hill, Wanstead, Leytonstone, Leyton, Walthamstow, Chingford, and to members of the Commons Preservation Society; to the Press; to gentlemen known to be favourable to open spaces; and to the body of members of the Club.

Conveyances were in attendance at Stratford, Ilford, Woodford, &c., and the first rendezvous was at Grange Hill, Chigwell, to inspect the piece of well-wooded land of about 70 acres, which is included in the scheme.

Unfortunately the weather for days previous, and on the day of the meeting for part of the time, was exceedingly bad, and although at least 200 visitors were expected, only about 80 attended the meeting. The Conductor was Mr. E. N. Buxton, who exerted himself to the utmost to explain his plans and ideas.

Leaving Grange Hill, the ride was continued through Chigwell Row, past the well-known "Beehive" Inn, and the Lambourne Forest was entered at Crabtree Hill.

The Times of June 17th gave an excellent report of the meeting, "from our Special Correspondent," and we cannot do better than quote from it, omitting those paragraphs descriptive of the scheme itself, which are unnecessary in view of the paper in another part of the present number:

"The fine idea of re-creating Hainhault Forest and adding it to Epping for an East London play-ground, bids fair to be realised in no long time. It has excited much interest, which was put to a severe practical test on Saturday, when a party of over 80, including three or four courageous ladies, faced the weather at the invitation of the Essex Field Club and tramped over the ground under the guidance of Mr. E. N. Buxton, the Verderer of Epping Forest. They will not forget it. The day may have struck people as rather wet elsewhere—at Lord's cricket ground, for instance—but the wetness of the forest in a rainy season is a thing apart, not to be measured by ordinary standards or encountered in ordinary clothes. The turf was a sponge, every tree and bush a shower-bath, every hollow a pond, and all the little grassy water-courses, that have been dry season after season for years, were swift running streams. But Mr. Buxton spared the visitors nothing and they shirked nothing. For the best part of three hours they tramped the turf, jumped the water-courses, plodged through the ponds, squelched through the mud, and scrambled through the bushes, not without damage, but with unflagging interest and good humour. It does not sound enjoyable, but it was. Nobody grumbled,

and nobody gave in. More convincing testimony to the genuine attraction of the place and the project could not be imagined. At Cabin Plain a large tent had been pitched, and tea was provided, after which the details of the scheme were explained by Mr. Buxton, and complimentary speeches were made by Professor Meldola, President of the Essex Field Club, Mr. Shaw Lefevre, President of the Commons Preservation Society, Sir Robert Hunter, Mr. David Howard, Mr. F. C. Gould, and other gentlemen. A curious and slightly sinister background was formed by a ring of gipsies, who have a very particular interest in the matter, and who drew near to listen to their fate. They did not betray the slightest emotion, perhaps because several constables were present in their honour, or dishonour."

A vote of thanks to Mr. Buxton for his persevering and most successful work in connection with the scheme, was passed with acclaim, and Mr. Buxton, in reply, wished to emphasise his indebtedness to his colleagues on the Commons Preservation Society for loyal and effective support during the difficult negotiations.

After giving a short sketch of the history of the Hainault enclosures, the *Times* Correspondent continued :—

"The present scheme is to reverse the former process and reclaim a substantial portion of this lost forest. The author of it and the conductor of the negotiations—with the moral support of the Commons Preservation Society—is Mr. Buxton, who has long been a vigilant and generous champion of the preservation of nature for the benefit of the people. The extent of his success and the amount of land reclaimed will depend on the public response, which has so far been very encouraging. Topographical details without a map would be merely confusing, but some idea of the plan can be given. The negotiations already entered into cover two separate areas, one of about 800 acres and the other of 70 acres. The nucleus of the first is Lambourne Common, which consists of 188 acres of virgin forest land. It is here that the gipsies camp. Their number varies, but, as a rule, runs into several hundreds. On Saturday they had between 60 and 70 vans on the green, besides tents. They help themselves to the trees for firewood, and their depredations, which are painfully visible, have long exercised the mind of the Commons Preservation Society. In fact the necessity of getting rid of the gipsies has considerably stimulated the scheme. It is proposed to acquire the timber and the manorial rights of the common, and to add to it three adjoining plots of enclosed land. One of these is still in a forestal state, the others are cultivated. The most important is an area of 475 acres belonging to the Crown. The ground is high and hilly, and commands a view right across the Thames. The remaining and separate portion is known as Grange Hill Forest. It lies near Woodford Bridge and is a beautiful piece of pure forest. In all there will be 346 acres of forestal and 527 acres of cultivated land. Mr. Buxton's idea is not to plant the latter with the trees, but to lay it down in grass and sow trees, or let them sow themselves, which they do in a very interesting manner. Thorns and briars soon spring up and afford protection to the young saplings. In nearly every patch may be found a young oak or hornbeam. The trees, it is to be noted, run considerably larger, where they still exist, on the Hainault side than in the greater part of Epping Forest. There is no doubt that the whole area will become extremely beautiful when reafforested. It lies high and will afford good golf links. It will also be very accessible from the great eastward extensions of London by the new Great Eastern loopline, now under construction, which turns north soon after leaving Ilford and curves round by Barkingside and Chigwell Row to Woodford Bridge."

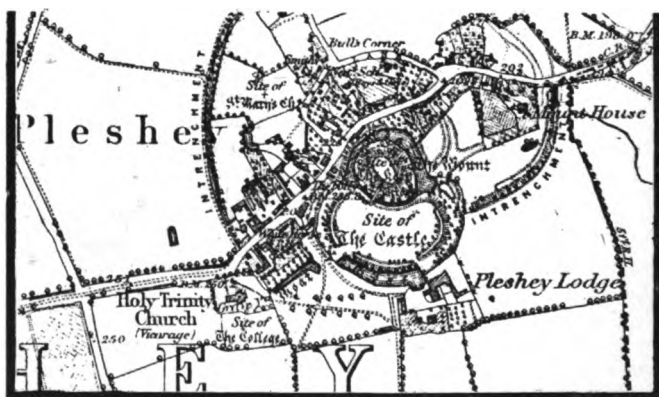
This interesting and important meeting concluded, Mr. Buxton continued his demonstrations, and ultimately the carriages were resumed at the Chigwell Row "Recreation Ground," which abuts on the new Hainhault. The rain commenced, and continued the whole way home.

[It should be mentioned that a large informal meeting was held on the previous day, and much of the ground traversed by members of the County Council and others whose engagements prevented their attendance on the Saturday. Mr. Buxton then also acted as leader and demonstrator. The rain was persistent during the whole afternoon, and the site of the marquee on Cabin Plain and the ground around was literally flooded.]

VISIT TO PLESHEY AND TERLING PLACE.

TUESDAY, JUNE 17TH, 1902.

This meeting was intended to afford an opportunity of seeing the very interesting village of Pleshey and to take advantage of the kind invitation from Lord and Lady Rayleigh to visit them at Terling Place.



PLAN OF THE PLESHEY EARTHWORKS.

From the Ordnance Survey Map (scale 6 inches=1 mile).

The assembly was called at 10 o'clock at Chelmsford Railway Station, where brakes were waiting. The party was comparatively small, owing to the rainy weather of the past week or ten days. The conductors were Mr. Chalkley Gould and Mr. Miller Christy, F.L.S.; Dr. Laver, who was to have given his valuable services, was unfortunately detained at Colchester by professional work.

The rain held off during the very pleasant ride through the villages of Broomfield, Great Waltham, and so along a by-road to Pleshey. The country looked very bright and fresh, and there was an abundance of early summer way-side flowers. The luxuriant foliage of the trees and hedges, especially characteristic of the present summer, was everywhere recognised with delight.

Pleshey has evidently been a settlement from the very earliest times. According to Mr. Horace Round, the name comes from old French *Plaisseis*, meaning an enclosure with pales closely interlaced. The great entrenchment which surrounds the village is probably British (T. V. Holmes, *ESSEX NAT. x.*, 151), but the period

of the mound upon which once stood the keep of the Castle, built soon after the conquest by Geoffrey de Mandeville, Earl of Essex, and High Constable of England, is more doubtful. Conjecture on these matters is useless in the absence of systematic exploration. Mr. Chalkley Gould demonstrated the most interesting features of the earthworks, and distributed the plan of them prepared for his chapter on Ancient Earthworks in the *Victoria History of Essex*; but, unfortunately, a heavy fall of rain forbade a thorough inspection, and a retreat was made to the inn for lunch. Here Mr. Gould gave a capital *resume* of the later history of Pleshey. The Castle passed from the Mandevilles to the De Bohuns, and later came into the hands of Thomas of Woodstock, uncle to Richard II., and it is in Shakespeare's "Richard II." that Pleshey is mentioned.

The reader is referred to Mr. Horace Round's article in *Trans. Essex Arch. Soc.*, vol. v. N. S. pp. 84-86, and to Mr. Gould's notes in the *Victoria History of Essex*, vol. i., pp. 297-9) and also, for much information on the general subject of earthworks resembling Pleshey, to Mr. T. V. Holmes' article in the *ESSEX NATURALIST*, vol. x., pp. 145-158, entitled "Notes on Ancient Defensive Earthworks in connection with those of Rayleigh 'Castle,' Essex."

Mr. Gould pointed out an old stone, with an incised inscription "Ricardus Rex ij," let into a wall near the Castle Keep.

Dr. Laver has, we understand, some Bronze Celts stated to have been found at Pleshey, and in Murray's *Handbook to the Eastern Counties* it is stated that urns and other antiquities have been found there. But how curious it is that antiquaries should spend their lives in endeavouring to extract some meagre information respecting such earthworks from old records, when a week or two's work with the spade and the expenditure of a score of pounds would probably afford *data* of the greatest interest in the consideration of the period of such entrenchments.

Leaving this old-world village, the drive was continued by How Street and through charming lanes, by verdure-clad hedgerows and waving corn-fields, through Great Leighs, and so skirting the valley of the Ter River, to the little village of Terling, celebrated the world over as the residence of one of the greatest experimental physicists of his age.

Here we were met by the President and Mrs. Meldola, and by our Vice-President, Mr. J. C. Shenstone, who had cycled over from Colchester. At the Church of All Saints, the party was welcomed by the Vicar, the Rev. C. Boutflower, M.A., who very kindly explained the most interesting features of the building. The nave is apparently 14th century decorative work, and there are some good brasses.

The park adjoins the Church, and at Terling Place a very kindly welcome was given by Lord and Lady Rayleigh, who personally conducted the visitors over the beautiful grounds. The Park is famous for its fine trees, and the garden-wild abundantly testified to Lady Rayleigh's skill as a horticulturist. The association of wild and cultivated English plants with foreign shrubs and flowers was greatly admired, producing often some charming combinations of colour and form.

On the terrace Lord Rayleigh gave a demonstration of his new signal trumpet, which he had constructed in connection with his work as a scientific adviser to the Trinity House.

Time would not permit of a long ramble in the garden, and the party was summoned to tea in the house. The dining-room in which it was served contains some notable portraits of members of the family and others.

Moving into the drawing-room, an ordinary meeting (the 214th) of the Club was held, Prof. Meldola taking the chair. The President referred to the proceedings of the day, and proposed that thanks should be made to the Conductors, Mr. Gould, Mr. Christy, and the Rev. C. Boutflower. He said that he was sure all present appreciated highly the kindness and hospitality of their host and hostess. It was 17 years ago (on July 25th, 1885)¹ since the Club had visited Terling Place, and during that time Lord Rayleigh's scientific activity had never flagged. He was sure that all would listen with the greatest interest and profit to the address which his Lordship had so kindly promised to deliver.

Lord Rayleigh expressed the pleasure it gave to him and Lady Rayleigh to see the Club again in their house. He then gave a most interesting address on "Colour in Nature," explaining the optical principles of absorption, reflection, and refraction, to the action of which on the white light of the sun we owe colour. In the course of the lecture he referred to what is called "colour-blindness," a somewhat loose term, as the inability to recognise colours was never complete, and it varied greatly in different individuals. It was almost unknown among women. In spite of that fact, however, colour-blindness was strictly hereditary, and could be passed on through the mother as much as through the father, but only showed itself in the males. It was not uncommon, he said, for heavy smokers to become colour-blind. A man might smoke heavily the worst kind of tobacco for many years, and it might not take effect, but if he got low spirited through mental distress or some trouble, then the tobacco would take effect on his colour vision, and there was no remedy except to give up the tobacco.

Some discussion on matters arising out of the address was carried on by the President, Mr. Shenstone, Mr. I. C. Gould, and others, and Lord Rayleigh replied to questions.

A vote of thanks to Lord and Lady Rayleigh was most heartily accorded.

The return journey was then taken to Chelmsford, the brakes being stayed at Springfield to allow of a brief inspection of the Norman Church. It is a fond tradition with Essex people that Oliver Goldsmith once lived at Springfield, and that the picturesque village-green suggested some of the imagery of his immortal poem.

SUMMER WOODLAND RAMBLE AND 215th ORDINARY MEETING.

SATURDAY, JULY 26TH, 1902.

On this afternoon the members assembled at Theydon Bois at about half-past three, for a woodland ramble. The main object was the observation of SPIDERS, under the guidance of Mr. Frank Smith, author of the papers on the "Spiders of Epping Forest" now running through the *ESSEX NATURALIST*.

The route was through Epping Thicks, Ambresbury Banks, to a spot just off the "Verderer's Path," Honey Lane Quarters, where a tent had been erected by permission of Mr. McKenzie, the Superintendent of the Forest.

Many interesting species of spiders were observed, and Mr. Smith gave several demonstrations of habits and modes of concealment affected by some of them. A few insects were seen, and the usual forest plants were pointed out to those amateur botanists present.

Tea was served in the tent by Mr. J. Riggs, of Buckhurst Hill.

¹ See *Journal of Proceedings E.F.C.*, vol. iv., p. clxxii

Afterwards, the 215th ORDINARY MEETING was held, the President, Prof. R. Meldola, in the chair.

New Members.—Mr. P. L. Levenson and Mr. Victor Taylor were elected members of the Club.

The "Horace Brown" Collections.—The Secretary announced that their member, Mr. Horace T. Brown, F.R.S., had presented to the Club the whole of his extensive collection of British Fossils, a collection of Rock Specimens, and a number of British Marine Mollusca. [The collection will be more particularly described in a "Museum Note" in a future part.]

The President said that they were greatly indebted to Mr. Brown for this fine collection, and although Mr. Brown was at present out of England, it was only proper that they should take the first opportunity of expressing their high sense of his kindness.

A vote of thanks to the donor was passed by acclamation.

Report on Spiders Observed.—Mr. Smith made a brief report on the species observed during the afternoon's ramble. Several of them were rather rare, and two or three were of interest in consequence of their habits. [The list has since been compiled by Mr. Smith, and is printed in the present part, *ante* pp. 22-3]

Protective Resemblance.—Prof. Meldola called attention to a beautiful instance of this in the caterpillar of the "Large Thorn Moth" (*Ennomos autumnaria=alniaria*), some specimens of which in the living state were exhibited by Mr. J. A. Finzi, bred from eggs laid by a moth captured by Mr. Meldola at Bognor, Sussex. The larvæ, like most of its family, is extremely "stick-like," and the special point noted by Mr. Meldola was that the second pair of claspers are so formed and shaded as to closely resemble a bud projecting from the twig, so wonderfully aiding the general affect.

Conference Meeting at Ipswich.—The Secretary stated that he had most regretfully decided to abandon this meeting for the present year, in consequence of great difficulties of organisation, the principal being the excessive cost of the hire of a steamer for the proposed two days. It might be possible to arrange a Conference of the East Anglian Societies in some other town next year.

After the close of the meeting a very pleasant return ramble was taken across the forest to Loughton Station.

THE ANNUAL "FUNGUS FORAY" AND 216th ORDINARY MEETING.

FRIDAY AND SATURDAY, OCTOBER 17th AND 18th, 1902.

The meeting on the Friday was held in the neighbourhood of North Weald and Toot Hill, Mr. Primrose McConnell, B.Sc., F.G.S., acting with the Secretaries as local leader. The Ongar Park Woods were carefully searched over for Fungi, and although the individual plants were few, yet by the persevering efforts of the party a fairly good number of species was obtained. The weather was very fine and sunny, and consequently the pleasant woodland ramble was much enjoyed. Luncheon was served at the "Green Man" Inn, Toot Hill, and in the afternoon the specimens were taken by the Secretaries to the temporary Headquarters for the meeting, the "King's Oak Hotel," High Beach, where Dr. Cooke received and determined the names of the fungi.

On the Saturday there were two parties; one starting about noon from Theydon

Bois Station, and busying themselves with collecting in the woods north of High Beach. Mr. Arthur Lister, F.R.S., F.L.S., and Miss G. Lister, very courteously acted as Botanical Referees. Mr. Lister's report on the Mycetozoa observed will be found elsewhere (*ante* p. 12). A later party took the more southerly woods, and High Beach itself. The collecting parties met at the Headquarters in the late afternoon. Mr. George Massee, F.L.S., Dr. Cooke, Mr. Lister, Miss Lister, and others, determined the species, and the specimens were all labelled and arranged in botanical order on the tables, where they formed an interesting and instructive exhibition.

Diagrams of Fungi.—Dr. Cooke brought with him a series of nine large diagrams, depicting the morphology of the main groups of Fungi, all of them drawn and coloured by himself with his accustomed knowledge and skill. [We are glad to say that these fine drawings have since been secured for the Club's Museum.]

Ordinary Meeting.—The weather was very bad in London and elsewhere, and even on the forest rains fell at intervals, and in consequence the attendance during the evening was much restricted — a most regrettable result, as scientifically the meeting was one of the most interesting botanical gatherings for many years.

After tea, the 216th ORDINARY MEETING was held, Mr. T. V. Holmes, F.G.S., *Vice-President*, in the chair.

The Chairman read a telegram from the President, in which Prof. Meldola regretted that his duties at that afternoon's meeting of the Teachers' Registration Council prevented his attendance. He added that it was the first Fungus meeting he had missed since the foundation of the Club.

New Members.—Mr. T. G. Keulemans and the Rev. Rowland T. Warren, B.A., F.R.G.S., were elected members.

Reports on the Fungi.—Dr. Cooke then gave an address, "Work in the Field amongst the Fungi." This paper is printed in the present part, together with reports on the species observed by Dr. Cooke and Mr. Massee, and on the Mycetozoa by Mr. Lister.

Mr. George Massee, F.L.S., also gave a short address on the study of Fungi, urging that greater attention should be paid to the smaller forms, and particularly that "Life-histories" should be traced both in the laboratory and the field.

Fungoid Disease of Hornbeams.—Mr. R. Paulson made a few remarks on this subject, for which see "Notes."

Thanks to Conductors.—At the invitation of the Chairman, very cordial votes of thanks were passed to Dr. Cooke, Mr. Lister, Mr. McConnell, and Mr. Massee for their valuable aid during the meeting.

The remainder of the evening was spent in examining the specimens collected. The number of species new to the forest, and the number actually determined, was probably greater than at any previous "Foray," and the changeable weather was the only hindrance to the complete success of the meeting.

THE 217th ORDINARY MEETING.

SATURDAY, NOVEMBER 8TH, 1902.

This meeting was held in the Municipal Technical Institute, Stratford, the President, Prof. R. Meldola, F.R.S., in the Chair.

Members Elected.—R. Bruce Boswell, M.A., W. Arnold Burgess, B.A., and Lawrence W. Chubb (*Secretary to the Commons Preservation Society*).

Books Presented.—The translation of *De Magnete*, published by the Gilbert Club, presented by Professor Meldola, and the supplemental volume of *Notes* by the Editor, Prof. Silvanus Thompson, F.R.S.; *Agricultural Geology*, presented by the Author, Mr. Primrose McConnell, B. Sc.; *Reminiscences of a Yorkshire Naturalist*, by the Executors of the Authors, the late Prof. W. C. Williamson, F.R.S., and *Catalogue of Essex Books, etc., in the library of Augustus Cunningham*, presented by his Executors. Thanks were returned for these donations.

The "Essex Skipper Butterfly."—Mr. W. Cole exhibited and presented to the Museum a series of *Hesperia lineola* recently taken on the Essex Coast by Mr. B. G. Cole and himself. The insect was first recognised as a British species by Mr. F. W. Hawes from the examination of specimens taken in July, 1888, at St. Osyth, Essex (ESSEX NATURALIST, iv. 191, and v. 107).

Moths Killed by Bats.—Mr. Cole also exhibited a number of fragments of wings of moths, supposed to have been killed by bats (see "Notes" in present part).

¶ The President said that the exhibit was interesting in view of the study of the relation between insects and their enemies.

∴ **Brown-tail Moth.**—Another exhibit was a specimen of *Porthesia chrysorrhea* empaled upon the spine of a furze-bush by one of the Butcher-birds. Mr. Cole made some remarks on the capture of this moth by sparrows, which are embodied in a "Note" on another page.

Essex Cephalopoda.—Mr. Cole placed on the table specimens of the five species of this group known to occur in the Essex waters. They had been obtained by himself off the coast, and by Mr. Goodchild from the deeper parts of the North Sea. The species were:—*Octopus vulgaris*, *Loligo forbesi* (= *vulgaris*, Jeffreys), *L. media*, *Sepioloa scandica* (= *rondeleti*, Jeffreys) and *Sepia officinalis* (the cuttle-fish). The specimen of *Sepia* was very small, as is usually the case with those found near the Essex coast, although fine examples of the "bone" were often picked up on the sands after storms. The specimens of the Octopus and the Squid were from near the Dogger Bank.

Mr. Walter Crouch said that it was very interesting to see all the Essex species of Cuttle-fishes in one view. He pointed out that the specimen of the Squid exhibited was smaller than the one dredged up from the Crouch river in 1891, which had come into his possession, and which he had described in the ESSEX NATURALIST (Vol. xi., 87). This specimen measured 14½ inches long in the body, and from the end of the body to the extreme tips of the long arms, 2 feet 5 inches. He had attempted to preserve this specimen, but without success.

Essex Marine District.—In reply to a remark by Mr. Whitaker, who "congratulated the Club on having annexed the North Sea," Mr. Cole said that in the Museum he proposed to take as Essex specimens those found in the North Sea up to a line drawn midway between Essex and the Continent, and this would include the Dogger Bank. This plan was in accordance with recommendations of the Committee of the British Association "For the purpose of considering the question of accurately defining the term 'British' as applied to the Marine Fauna and Flora of our islands." The 100-fathom contour line, the natural boundary on the N. and W., was non-existent off our shallow coast, and therefore the only available boundary for the Eastern "Shallow-water District" was as above defined (See ESSEX NAT. ii., 40, and Laver's *Mammals and Fishes of Essex*, p. 13).

A report by Dr. M. C. Cooke on the scientific results of the FUNGUS FORAY on October 17th and 18th last, was read, and thanks were voted to the author. This paper is printed in the present part (*ante* p. 5).

Delegate's Report.—Mr. W. Whitaker, F.R.S., F.G.S., gave *vera voce*, his report as Delegate of the Club at the Conference of Local Scientific Societies at the British Association meeting at Belfast. The substance of Mr. Whitaker's remarks will be printed in the E. N.

The President proposed that the thanks of the Club should be given to Mr. Whitaker for his services as Delegate at Belfast, and for the report he had just made.

Some observations on the value of Geological Photographs were made by Mr. Primrose McConnell, and Mr. Briscoe announced that he wished at the January meeting to bring forward a proposal for a Photographic Survey of Essex, to be worked in connection with the Essex Museum.

The vote of thanks was carried by acclamation, and Mr. Whitaker briefly replied.

Lecture on "Insect Life."—Mr. Fred. Enock, F.L.S., F.E.S., then delivered a lecture on the life-histories of some typical insects, which was illustrated by a very fine series of lantern slides, many of them being coloured. Mr. Enock delightfully related the results of many original observations, and the patience and skill shown in securing photographs of the actual acts of transformation and habits of some species were greatly admired by all present.

The President proposed a vote of thanks to the lecturer, and said that in listening to Mr. Enock he always felt that an observer of nature was speaking and not a mere cut-and-dried relator of other men's work. The vote of thanks was most heartily accorded.

NOTES—ORIGINAL AND SELECTED.

ZOOLOGY.

MAMMALIA.

Black Hare in Essex.—Mr. E. H. Watts records in the *Field* of January 24th, 1903, the killing of a black hare near Bishops Stortford. In reply to our enquiries, Mr. Watts says that it was a buck and perfectly black, and he thinks from one to two years old. Several melanic forms of the hare are mentioned in Dr. Laver's book from Epping and Ongar, and the Editor of the *Field* writes that seven are recorded in the *Encyclopædia of Sport*. They are doubtless rare, or we should hear of them more frequently.—ED.

The Deer in Epping Forest.—The last census recorded in the E.N. was that taken in 1898 (Vol. xi., p. 52). By inadvertence the counting made on the 8th January, 1901, was omitted

from our pages. On that day, 186 Fallow and 6 Roe were seen, and it was estimated that in addition about 50 fallow and 30 roe deer belonging to the Conservators were hiding in coverts of estates adjoining the forest. This is an encouraging record, showing the vitality of the herds.

BIRDS.

Tawny Owl Breeding in Colchester.—This evening, June 17th, 1902, I went with a friend to look at the owls in St. Mary's Churchyard and the Rectory Garden, in the centre of this town, within 150 yards of the High Street. We had the pleasure of seeing at one time in an acacia tree, five Tawny Owls (*Syrnium aluco*) and hearing three others, young ones, on other trees, calling for food. One of the five had previously been sitting on a chimney-pot of a house near by, hooting and squeaking. Persons passing through the Churchyard did not seem to alarm them.—HENRY LAVER, F.L.S.

[In a letter dated August 11th, Dr. Laver adds :—"The owls are still about here, and are just as noisy as ever."]

Hoopoe at Donyland.—On Friday, Saturday, and Sunday, August 8th to 10th, 1902, Col. Holroyd saw a Hoopoe in his grounds at Donyland Lodge. It was not at all shy, and came very near to the windows of the house. It has now left, and one can only hope that wherever it may go it will receive the same hospitality. It was, I understand, very amusing to see the curiosity shown by the other birds in the grounds at this stranger; they were evidently surprised at such an uncanny visitor.—HENRY LAVER, F.L.S.

Black-headed Gulls on the Thames Embankment, and their Habits.—The gulls on the Thames above bridge have been very numerous this winter and excellent opportunity of watching them can be found on the Embankment. In spite of the open weather, there have usually been a couple of hundred or so in the reach between Blackfriars and Waterloo Bridges. The favourite manner of feeding them is by throwing pieces of bread into the air for the birds to catch, and if the food is thrown up to a fairly uniform height the birds never miss it. When I have been watching them the wind has been fairly up or down

the river, or at least not directly across it, and the birds have always approached the feeding place against the wind, unless the breeze is very light indeed. A gull comes along at speed close beside the wall until within a few yards of the spot, when down go both legs, and the outspread webbed feet are violently paddled in a direction contrary to the motion of running or swimming and speed is instantly slackened. Sometimes a more than usually skilful bird will, by the aid of tail, feet and wings, jerk itself into an upright position, and then with rapid strokes of wings and legs fly and drift backwards with the wind for a few moments. The purpose is to hang as long as possible opposite the spot whence the expected morsel will appear. When the piece of bread is thrown up, all the birds close enough dash for it, and that one which chances to be nearest, or is quickest in its movements, obtains the prize. The legs seem quite as useful for steering as the tails. I was very astonished when I first noticed this power of kicking forwards, which is so effective. If the bird wishes to slow up and change its direction at the same time, one foot alone is dropped, and when wheeling suddenly to left or right the opposite foot pushes on the air just as a man would use his hands when turning in the water. It is clear that the bird which has attained the greatest skill in stopping its way has the best chance of being in a favourable spot for a dash at the food when thrown up, and this skill can hardly have been obtained when hawking cockchafers¹ and must be largely developed by this particular fashion of feeding the gulls. It would not be sufficient for a bird merely to approach at a slow and even rate, because one which did this would pass the spot a fewer number of times per hour than one which was able to fly quickly as soon as it had passed, and, coming round at speed, slow up suddenly in the important place. Of those birds also, which happen to be sufficiently near when the food is thrown up, the one which is most skilful in steering has the best chance of catching it. The gulls will soon be leaving London for the breeding places in the Essex marshes. Now, at the end of February, they are beginning to deserve the title "black-headed." During most of the winter their heads are of snowy whiteness.—F. W. ELLIOTT, *Buckhurst Hill, Essex, February 27th, 1903.*

¹ "In the months of May and June they are very busy in the pursuit and destruction of the cockchafer."—Mr. Hill in Christy's *Birds of Essex*, p. 266.

FISHES.

The "Goldsinny" or "Corkwing" in Essex Waters.—In a box of fish specimens sent to the Museum from Brightlingsea to-day, I was pleased to find an example of the "Goldsinny" or "Goldfinny," *Crenilabrus melops*. It was probably caught off the Buxey Sands, the spot frequently worked by the fisherman, Mr. Welham. The fish was unknown as a local species to Dr. Laver when he wrote the *Mammals and Fishes of Essex*, but he mentions that the late Dr. Bree had described two specimens taken off the coast (*Field*, December 1st, 1866, p. 420). And we gather from a note in Dr. Laver's paper on Essex Fishes in the *Victoria History* that Dr. Murie has sent specimens to the British Museum from the Thames Estuary. It is either very rare in Essex waters, or is overlooked by the fishermen—and as it has no food value the latter is the probable explanation.—W. COLE, *March 7th*, 1903.

INSECTS.

The "Colorado Beetle" at Tilbury, Essex.—About the end of May, 1902, *Doryphora decemlineata* made its unwelcome re-appearance at Tilbury. In August, 1901, its presence in some allotments in Tilbury Dock was reported to the Board of Agriculture; the beetles had been observed for some time, and in August they were breeding with great energy. Eggs, larvæ in all stages, and adults, were found on a large patch of potatoes. In 1902 traces of the destruction were found in several fields in Tilbury as well as in the allotments. There can be no doubt that the great vitality of *Doryphora* in the perfect state renders it an enemy to be dreaded. The insects have been kept for weeks without food; have withstood immersion in chloroform, 40 per cent. formalin and in paraffin for some hours, and apparently they can float unharmed for days in water. Nothing is easier for these beetles, which swarm in America, and which have been seen flying about the streets of New York, to settle upon some outward bound vessel, and in the case of a pregnant female on arrival in the Thames, to fly to the potato fields, lay eggs, and so set up a colony. The climatic conditions of this country are not unfavourable. The insect, says Riley, is northern rather than southern in its distribution. A great number of natural enemies tend to check the increase of the beetle in America. At Tilbury

the Seven-spotted Ladybird (*Coccinella 7-punctata*) was noticed in numbers on the potatoes both as adults and larvæ, and the latter when placed in a box with eggs of the *Doryphora* ate them ravenously. A small Hemipteron, a green *Nemoricoris* (?) was also seen wandering about among the larvæ, and may have been sucking the body juices, as several species do in America. The above facts are mainly taken from a very interesting report to the Board of Agriculture by Prof. F. V. Theobald (*Journal*, vol. viii., pp. 147-154). Under the terms of the "Colorado Beetle Order, 1877," if *Doryphora* is found wandering around anywhere, notice must be at once given to a constable (!), but please also send the errant beetles to the Essex Museum of Natural History.—Ed.

Brown-tail Moth and Birds.—On the Essex coast, at St. Osyth, we found (in August last) a specimen of this moth (*Porthesia chrysorrhæa*) empaled upon the spine of a furze bush, probably by the butcher-bird or red-backed shrike (*Lanius collurio*). The caterpillars of the brown-tail moth have again been very common on the coast, and they certainly are "protected animals," with their bright colours and tufts of hairs; the cuckoo is said to be the only bird that will eat them. I had imagined that the perfect moth was likewise distasteful to birds. But we noticed that a pair of sparrows, who had set up housekeeping in the roof of the Martello Tower at St. Osyth, constantly fed their young on the moths, which they took off the hedges surrounding the tower. On one occasion as we watched, the cock bird brought in nine specimens in a very short time. and he stuck to his work from morn till eve. I have since found, on reference to Prof. Poulton's *Colours of Animals*, that this curious exception (the larva being a protected form and the perfect insect an edible one) has been noticed in the allied *Porthesia auriflua* (the gold-tail moth). The Professor is inclined to think that *P. auriflua* is a mimicker of the white-satin moth, *Stilpnotia salicis*, which he has proved experimentally to be unpalatable to insectivorous animals.—W. COLE, *Buckhurst Hill*.

Bats (?) and Birds Catching Moths.—At the meeting of the Club, on November 8th, I exhibited a number of wings of crepuscular and night-flying moths, which had been found on the floor of the verandah facing the garden, at

my house at Buckhurst Hill. The wings were found in the early morning scattered over the floor. Bats are very numerous in the garden, and have been seen "hawking" in and out of the verandah, and I feel tolerably certain that they were the culprits.

The moths determined belonged to 16 species, viz.:—

<i>Smerinthus populi.</i>	<i>N. xanthographa.</i>
<i>Pygma bucephala.</i>	<i>Plusia gamma.</i>
<i>Notodonta camelina.</i>	<i>Mania typica.</i>
<i>Xylophasia polyodon.</i>	<i>M. maura.</i>
<i>Luperina testacea.</i>	<i>Amphipyra pyramidea.</i>
<i>Triphæna pronuba.</i>	<i>Selenia lunaria.</i>
<i>T. orbona.</i>	<i>Geometra papilionaria.</i>
<i>Noctua augur.</i>	<i>Botys verticalis.</i>

The exhibit was intended to show the constant and keen warfare carried on against moths by those animals preying upon them. My brother found wings of *Geometra papilionaria* in Birch Wood, Kent, in July, 1867. On June 30th, 1889, in company with Prof. Meldola, in the Epping Forest district, we picked up the wings of *Smerinthus tilia*, *Stilpnotia salicis*, and *Halias quercana*, which had evidently fallen victims to bats or insectivorous birds. B. G. Cole on two occasions actually saw birds snap the wings off moths—one a Pepper Moth (*Amphidasis betularia*) in New Forest (July, 1874), and the other a Leopard Moth (*Zeuzera asculi*), at Buckhurst Hill. In the evening, in both cases; the birds were not identified.—W. COLE, *Buckhurst Hill, November, 1902.*

BOTANY.

"The Existing Trees and Shrubs of Epping Forest."

—*Ribes grossularia*, L. There is a small plant of this species in a thicket near the Fairmead Road. It is too young for the variety to be determined.—F. W. ELLIOTT, April 7th, 1903.

Early Flowering of the Hawthorn.—Flowers are fully open on a hawthorn in Buckhurst Hill to-day, April 7th. The particular bush is an early blossoming one every year, but this is easily a record, in my experience.—F. W. ELLIOTT.

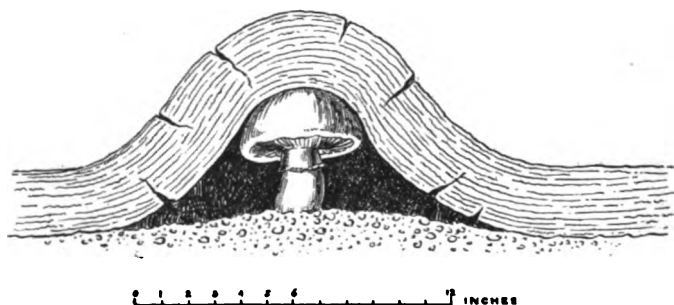
Mr. C. B. Sworder, of Epping, writes to the *Standard* under date April 10th. "Some May in bloom was picked to-day near here, my earliest record being May 17th, 1898, but I find February 16th, 1834, quoted in the *Penny Magazine*."

Lathyrus Aphaca. This plant was found on a bank by the side of a field near the Gatehouse Farm, Coggeshall. The

only place I had previously seen it in my radius was as a casual in a wheat-field at Witham, and then it only survived the one year.—EDWIN E. TURNER, Coggeshall, August 6th, 1902.

Narcissus Pseudo-narcissus in Epping Forest.—I cannot find any record of the Daffodil in the Forest, but there is a certain district where it grows very scantily for a distance of about 90 yards. I have not had the luck to see any flowers, but I came upon two little boys from Loughton one day in March, 1901, digging up the bulbs. They knew perfectly well what they were, and told me that they had seen the spot yellow with the flowers the previous year.—F. W. ELLIOTT, April 7th, 1903.

Growth-force of a Mushroom.—I send a rough sectional drawing of a curious mushroom growth. On August 4th, 1892,



I noticed that the pavement (asphalte or tar) on the east side of Norwich Road, close to the enclosure wall of Upton Congregational Chapel, was lifted conically, presenting the appearance of a miniature volcanic mountain. Upon investigation, I found that it was caused by the growth of a mushroom. The particular incident worthy of observation is the *force* exerted by the fungus to lift, not only the dead weight, but the impacted conglomerate of tar, sand and stones.—(Rev.) ROWLAND T. WARREN, *Christ Church Vicarage, Forest Gate, Essex.*

A Big Mushroom.—I have just been informed by Mr. Collis Willmott that he gathered a remarkable mushroom at Woodham Ferris, Essex, on the 28th of August, 1902, which deserves a record. It was a specimen of the Horse Mushroom (*Agaricus arvensis*), which most persons consider equal, and some

superior, for its edible qualities, to the common mushroom. The individual in question measured fifty-one inches in circumference, which would be equivalent to a diameter of seventeen inches, and its weight was over three pounds. It is not uncommon during a wet season to meet with specimens twelve inches in diameter, and even more, but I should consider the above to be abnormally large. Rather a full dish or a bachelor's breakfast.—M. C. COOKE, LL.D., A.L.S., Sept. 1st, 1902.

Fungoid Disease in Hornbeams.—In continuation of my paper "An enquiry into the cause of the Death of Birch trees in Epping Forest and elsewhere" (ESSEX NAT., vol. xi., pp. 273-284), I may mention that on several occasions this autumn, while making further notes on the progress of the disease that has destroyed so many birch trees, I have noticed several Hornbeams either partly dead, or quite so, in many parts of the Forest; notably in Lord's Bushes, Rushy Plain, Gilbert's Slade, and Bury Wood. At first it seemed probable that death might be due simply to old age, but on closer observations, young trees were found to have suffered as well as the old ones. In some cases, death has occurred since the formation of the fruit this summer. All the dead branches that have been examined, exhibit the hyphal threads of a fungus under the bark. The fungus most common on many of trees was *Corticium comedens*.—ROBERT PAULSON, October, 1902.

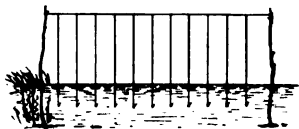
GEOLOGY.

East Anglian Tertiary Geology.—Our readers should have their attention called to "A Sketch of the Later Tertiary History of East Anglia," by W. F. Harmer, F.G.S., *Proceedings Geologists' Association*, Vol. xvii., Aug. and Nov., 1902 (Stanford, 1s. 6d.). Mr. Harmer's "Sketch" (pp. 416-479) is well illustrated by maps and sections; one map showing the distribution of the Crag around Walton-on-Naze and Harwich. The paper is so full of detail that it hardly admits of an abstract, but it will be found a very valuable one to Essex geologists. Mr. Harmer has been working at the geology of the Eastern Counties for 30 or 40 years. An account of the Excursion of the Association to Suffolk and Norfolk (July 26th to August 5th, 1902) follows in the same part, pp. 480-488. Walton was visited on July 28th. The reports will well repay perusal.

ANTHROPOLOGY.

A "Wooden Age" in Russia.—It is stated, in connection with the establishment by M. Witte, the Minister of Finance, of a Committee at St. Petersburg to familiarise the muzhik with the use of iron, and to bring iron implements within his reach, that the peasant in many parts of the country does not possess, all told, a shilling's-worth of iron in any form. His plough is wood, with a wooden share sometimes shod with any bit of metal handy; his harrow is entirely wood; his cart is pegged together with wooden dowels, and has often not a scrap of the nobler metal in its entire composition; his harness is rope and straps; the latter never have buckles, the straps being wound round and round until they grip, while his horse has very often not so much as its bit of iron. To turn to other articles, the muzhik uses wooden spoons, spades, eating bowls; cooking pots of clay lifted out of the fire by two forms of iron hook of the value, perhaps, of twopence; his hatchet is metal, of course, but his skill in its use has taught him to use dovetails and coarser joints everywhere in place of a nail. His dress is innocent of any use of metal; he does not wear boots the greater part of the year, and they have no metal in them for the most part when he does wear them, on great holidays; his girdle is a sash without buckle, and his buttons are wood, or knots and loops. Altogether, the inhabitant of another planet dropped into some districts of Russia would never, perhaps, realise that the metal ages had yet arrived upon this earth, and in characteristic Russian fashion the Minister of Finance is setting to work to remedy the evil, and provide in this way a home market which will suffice to keep alive the iron industry of the Empire when the Government ceases to build railways.—*Standard*, March 1st, 1903.

Primitive Fishing-Hooks.—In the *Amateur Photographer* for February 5th, 1903, there is a note on wooden fish-hooks, which is confirmatory of Mr. E. Lovitt's observations in the *Essex Naturalist* (vol. x. p. 300, and vol. xii. p. 28), on the use of such hooks on the Essex Coast and in France. The writer, "Menevia," says:—



"I was very surprised recently at Laugharne, a small Welsh fishing village which possesses a most picturesque old castle, to come on some fishermen using

as a regular thing in their daily work, not the commercial fishing-hooks as we know them, but the primitive common white thorns, cut from the hedgerows, which were, when bound in horsehair to the line, in their turn baited in the ordinary way. It is their usual mode of fishing for flat-fish, and they seem to see nothing strange or quaint about it. Their mode of operation is to get two upright sticks, and thrust them in the ground some eighteen or nineteen yards apart. A line is stretched from stick to stick, from which line on horsehair hang twenty hooks two feet six inches apart, duly baited with the worms. Each horsehair line is composed of eleven twisted hairs. The whole affair may be understood from the rough sketch."

Lake Dwellings and "Dug-Out" Boat.—Extensive remains of prehistoric Lake-dwellings exist in the (? alluvial) bed of the River Save, near Dolina, in Northern Bosnia, which in interest fall in no way behind the better-known remains of such settlements in Switzerland, and the record may serve to illustrate like settlements in the Lea Valley and at Braintree. The *Standard* of December 31st, 1901, reported on these Bosnian dwellings as follows:—

"The excavations made during the year now ending have surpassed all expectations in regard to the wealth of material obtained for the Bosnian Museum at Sarajevo. Four dwelling-houses built on piles—three of which are well preserved, while one has been buried—have been laid bare, as well as the burying place belonging to the settlement, containing a number of fine bronzes and urns. Numerous products of the potter's art, utensils of staghorn, weapons of bronze and iron, ornaments of bronze, silver, gold, and amber, seeds, and bones, compose the chief discoveries made so far. The results of these researches have a special value, in that they have determined the architectural construction of the pile dwellings with an accuracy which has seldom been attainable. One of the most valuable discoveries is a boat five mètres long, hollowed out of the trunk of an oak. This was found lying nine mètres below the platform of a pile dwelling, and must have lain there nearly three thousand years. The work of digging out this unique object, which can be matched in no Museum of Europe, took six days, and was so successfully carried out that the boat was brought uninjured to the Sarajevo Museum. The pile dwellings of Dolina belong to two different periods, and were in existence during the bronze and iron ages."

MISCELLANEA.

A Plea for the Oysters.—In the *Times* of December 31st, 1902, there is a letter signed "Susan Eliza Helena Martin, L.S.A., L.L.A.," with the above heading. The writer remarks that "Few people know how to prepare oysters for the table properly; if they did the fear of typhoid would be very remote indeed." The directions are as follows:—

"First immerse the shells in a large tub of pure, cold water, and allow some to run over them for a few minutes, perfectly cleansing them. Then drain the water

off, give them a fresh supply, placing in the tub a large lump of salt, and leave them for 24 hours. The oysters will then disgorge any unpleasant fluid they may have imbibed. They have practically had an emetic! Again pour away the fluid and place the shells in fresh water, with a small quantity of salt and a handful of oatmeal, and now the fattening-up process has begun; leave as before for one day. Throw away the water when this is completed, again immerse in pure, cold water, and the oysters, in a perfectly hygienic condition, are ready for consumption."

[Speaking as one who has never swallowed a *living* mollusc, I should be disposed to add, in the words of a celebrated wit, "and then throw them out of the window!"—W.C.]

Bird Snaring.—In the *Illustrated London News*, of Jan. 10, 1903, are two pages illustrating "The violation of the Wild Birds Protection Act: Snarers at work." One picture exhibits "Snaring and Poaching in Epping Forest during close time. Reassuring the police." The artist is Mr. P. Freutzeny. Below the bird-snaring picture are the remarks:—

"Few wild birds long survive captivity; but neither that fact, nor the fact that certain birds accustomed to feed on the smallest insects cannot possibly obtain the food essential to them, prevents their capture and sale to young or ignorant buyers. In a recent London County Court case, the defendant stated that he generally bought a hundred dozen linnets, skylarks, and other British song-birds a week. For linnets he paid two pounds for ten dozen."

The Effects of Fogs.—In the *Spectator* of December 6th there is an interesting article on "Fog," beginning with the remark:—"London clay and the Essex marshes are two factors which help to keep the soil and air of East London cold, and so to condense the vapour in the air till it turns to fog." After giving some personal experiences of fogs in London and elsewhere, the writer mentions the bewildering effects of fog on animals, remarking that "no bird sings or utters a call in such weather, perhaps because it fears to betray its whereabouts to an enemy." He gives the case of a blind man, who was in the habit of coming up every day from a little town two miles off, carrying notes and parcels, who became lost in a fog, and was seen wandering about in a field next to the road, feeling his way with a stick. He had scarcely ever lost his way before. Asked why he had gone astray (as fog might be supposed to make no difference to a blind man), he said that "in a fog the ground sounded quite different."

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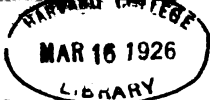
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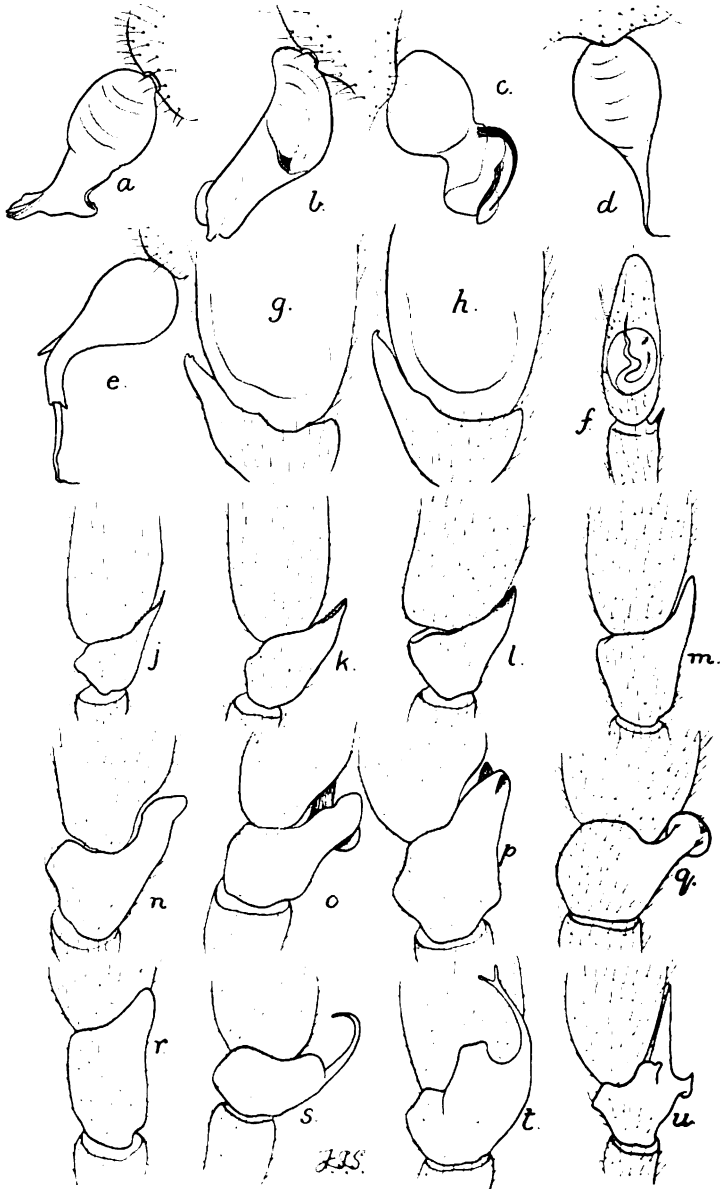
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PALP AND OTHER ORGANS OF MALE SPIDERS.

(PLATE IV.)

THE SPIDERS OF EPPING FOREST.

By FRANK P. SMITH.

(Continued from Vol. XII., page 201).

(With Plates IV. and V.)

V.—A SYSTEMATIC LIST OF THE SPIDERS OF EPPING FOREST.

IN the following descriptive list the names of those species which have been recorded as occurring in Epping Forest will be distinguished by being printed in thicker type. The term "Epping Forest" must be taken to signify the district defined by Mr. William Cole in the *ESSEX NATURALIST*, vol. vi., page 10, together with the recently acquired portions of the old "Hainbault Forest."

In order to economize space as much as possible, synonyms will be given only where the names here adopted differ from those employed by Rev. O. P. Cambridge in his *List of British and Irish Spiders*, this work being indicated by the abbreviation "Cambr. List." Length measurements of the species will not be given, but they can be obtained from the present writer's papers, entitled *An Introduction to British Spiders* (printed in *Science Gossip*).

DESCRIPTIONS OF PLATES.

PLATE IV.—PORTIONS OF PALPI OF MALE SPIDERS.

Fig. a. Dysdera crocata, Male Palpal Organs.

" <i>b. Dysdera cambridgii</i>	" "	
" <i>c. Harpactes hombergii</i>	" "	
" <i>d. Segestria senoculata</i>	" "	
" <i>e. Oonops pulcher</i>	" "	"
" <i>f. Drassus lapidosus</i>	" "	"
" <i>g. Prothesima subterranea</i>	} Male-Tibial apophyses viewed from	
" <i>h. Prothesima pedestris</i>		beneath.
" <i>i. Clubiona subtilis</i> .	Male.	Tibia, viewed from above.
" <i>k. Clubiona trivialis</i>	" "	"
" <i>l. Clubiona diversa</i>	" "	"
" <i>m. Clubiona terrestris</i>	" "	"
" <i>n. Clubiona lutescens</i>	" "	"
" <i>o. Clubiona grisea</i>	" "	"
" <i>p. Clubiona neglecta</i>	" "	"
" <i>q. Clubiona pallidula</i>	" "	"
" <i>r. Clubiona holosericea</i>	" "	"

¹See Note and Sketch-Map on the boundaries of Waltham Forest at page 75. Mr. Smith's limits for records may be held to extend over the district defined by the map.
—Ed.

- Fig. s. *Clubiona compta*. Male. Tibia, viewed from above.
 „ t. *Clubiona brevipes* „ „ „
 „ u. *Clubiona reclusa* „ „ „

PLATE V.—EPIGYNAL ARMATURE OF FEMALE SPIDERS.

- | | |
|-----------------------------------|----------------------------------|
| a. <i>Drassus lapidosus</i> | j. <i>Clubiona terrestris</i> |
| b. <i>Drassus blackwallii</i> | k. <i>Clubiona neglecta</i> |
| c. <i>Drassus troglodytes</i> | l. <i>Clubiona pallidula</i> |
| d. <i>Drassus minusculus</i> | m. <i>Clubiona holosericea</i> |
| e. <i>Prosthesima subterranea</i> | n. <i>Clubiona compta</i> |
| f. <i>Clubiona subtilis</i> | o. <i>Clubiona reclusa</i> |
| g. <i>Clubiona trivialis</i> | p. <i>Chiracanthium carnifex</i> |
| h. <i>Clubiona diversa</i> | |

ORDER ARANEAE.

SUB-ORDER OPISTHOTHELAЕ (POCOCK).

SECTION MYGALOMORPHAE (see vol. xii., page 192.)

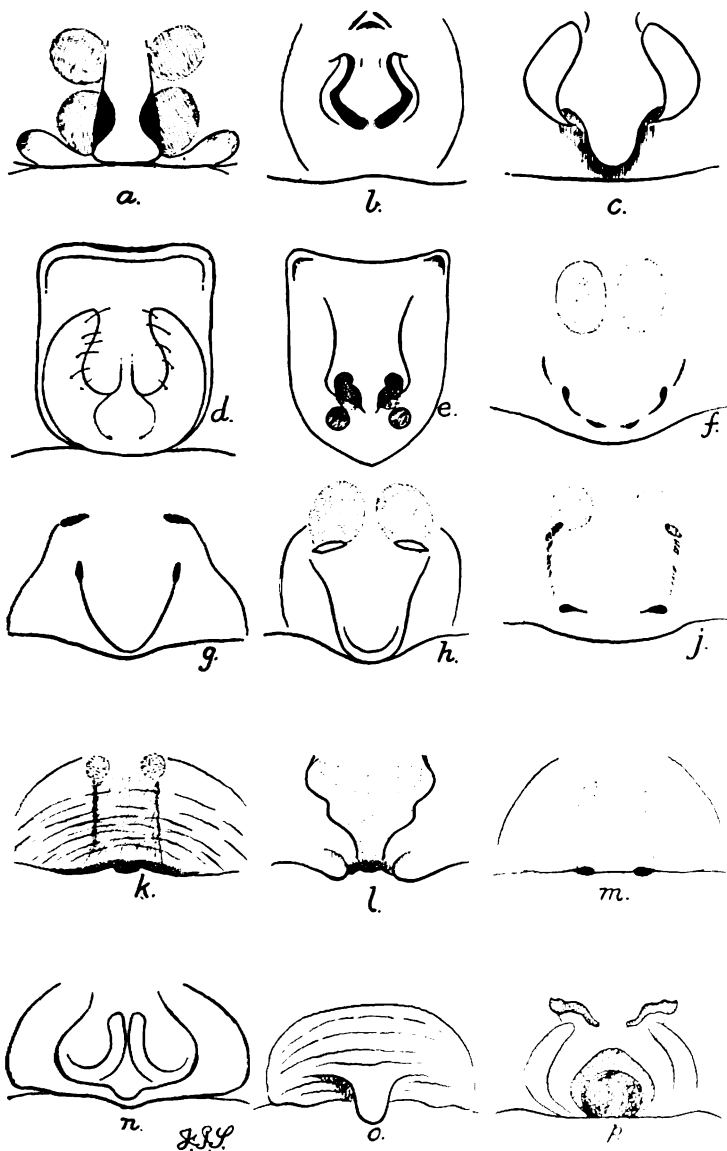
Family ATYPIDAE.

Cephalo-thorax usually with a longitudinal impression, but this is almost obsolete in *Atypus*. *Eyes* 8, arranged in three groups of 3, 2, 3. *Ocular area* small, broader than long. *Clypeus* narrow. *Falces* highly developed, articulated so as to permit of motion in a vertical plane: basal joint narrower beneath: fang groove absent, a single row of denticulations is present, and lies on the inner side of the fang when the latter is at rest. *Maxillae* usually absent, but well developed in *Atypus*. *Palpus*: Female: pediform. Male: palpal tibia without apophysis, palpal organs usually very simple, rather more complex in *Atypus*. *Legs* robust: tarsal claws 3. *Abdomen* rather short: a distinct anal tubercle is present above the superior spinners. *Laminal tracheae* four in number, the posterior pair being well separated from the anterior pair. *Spinners* normally 6, the superiors often long and upturned: cribellum absent. *Genital aperture of female* without special armature.

The Atypidae are spiders of rather large size and sombre colours, and are found chiefly in tropical and sub-tropical regions. The sexual differences are very considerable. Only one genus of this family is represented in Britain.

Genus ATYPUS Latreille.

Spiders of moderate size which spin partially subterranean tubes. They seize their prey through the substance of the exposed portion of the tube, the rent thus caused being afterwards repaired from the inside. One species of *Atypus*, *A. affinis*, Eichw., is not rare in the south of England, and another species, *A. beekii*, Cambr. has been taken on two occasions. Up to the present the genus has not been found in Epping Forest, although it is quite possible that it may exist in some of the sandy parts.



EPIGYNAL ARMATURE OF FEMALE SPIDERS.

For explanation, see text.

SECTION ARANEOMORPHAE (see Vol. xii., p. 192).

Family DYSDERIDAE.

[Dysderidae, Cambr. List, *ad. partem.*]

Cephalo-thorax varies in different genera: median stria very minute or absent. *Eyes* 6, homogeneous, of the nocturnal type, nearly equal, in a more or less compact group. *Ocular area* broader than long, narrower than the caput. *Clypeus* narrow. *Falces* articulated so as to permit of motion in an oblique or else in a horizontal plane, robust, more or less attenuated: basal protuberance absent: fang long, more or less robust: fang-groove margins dentated. *Labium* free, much longer than wide, recurved laterally, parallel sided or a little attenuated, always truncated at the summit, often even a little excavated. *Sternum* elongate oval, strongly impressed laterally, attenuated in front, always passing beyond the point of insertion of coxae I., posteriorly more or less obtuse between coxae IV., which are somewhat separated. *Maxillae* long and straight, not inclined, wide and more or less convex from base to insertion of palpus, then strongly constricted externally, then slightly dilated, obliquely truncated on internal side which is bordered by a long scopula. *Palpus*: Female: tarsus longer than tibia and furnished with a small, simple claw. Male: palpal tibia without apophysis; palpal organs simple and quite exposed. *Legs* usually rather robust and remarkable for the length of coxae and patellae I. and II.: Tarsal claws 2 or 3, pectinate, the teeth being almost always more numerous in legs I. and II.: inferior claws when present almost always unarmed: onychium usually absent. *Abdomen* elongate oval, or almost cylindrical, its integument very soft. *Tube-tracheal openings* 2, very distinct, situated not far from the laminal tracheae and somewhat oblique. *Spinners* short, forming a compact group, inferiors very close, consisting of a stout basal joint and a conical terminal joint: superiors very similar in structure to inferiors: cribellum absent. *Female genital aperture* simple, without special armature.

The Dysderidae spin no snare, but conceal themselves in silken tubes. The sexual differences are slight. Three very distinct genera are represented in this country, and may be separated by means of the following table.

TABLE OF DYSDERIDAE.

- | | |
|---|------------------|
| 1. Ocular area not much broader than long. Integument between the coxae strongly chitinated. Coxae somewhat globular. Tarsal claws 2 or 3. Tarsus of female palpus somewhat oval. Median spinners almost as long as inferior ones. Abdomen, grey, unicolorous | 2 |
| Ocular area much broader than long. Integument between the coxae normal. Coxae cylindrical. Tarsal claws 3. Tarsus of female palpus cylindrical. Median spinners slender, and much shorter than inferior ones. Abdomen with a pattern | <i>Segestria</i> |
| 2. Eyes arranged in the form of a horse-shoe, the anteriors well separated. Tarsal claws 2. Cephalo-thorax red or liver-coloured | <i>Dysdera</i> |

Eyes arranged almost in a circle, the anteriors very close together. Tarsal claws 2 or 3. Cephalo-thorax brownish or blackish *Harpace*

Genus DYSDERA, Latreille.

Spiders of moderate size, fabricating a silken, tubular retreat, in which the eggs are laid, apparently not protected by an ovisac. The females of the various species are extremely difficult to distinguish one from another.

Dysdera crocata, C. L. Koch. Theydon Bois. A male and some females, the latter probably of this species, found beneath stones.

One other species, *D. cambridgii*, Thor. is found in Britain.

Genus HARPACTES, Templ.

Spiders of elongate slender build, especially the males. Habits generally similar to *Dysdera*.

Harpace hombergii, Scop. This species is rather common and widely distributed in Epping Forest, and may usually be found in the summer amongst dead leaves, and during the winter months beneath loose bark.

Genus SEGESTRIA, Latreille.

Spiders of moderate size with the thorax brownish or blackish and the abdomen with a distinct pattern, consisting chiefly of a longitudinal series of large blackish patches upon a paler ground. These spiders live in tubes which are usually constructed beneath loose bark.

Segestria senoculata Linn. Widely distributed in the Forest, and usually common under the loose bark of hornbeams, etc.

Two other species of *Segestria* are found in Britain, *S. bavarica*, C. L. Koch, and *S. florentina*, Ross., but both are very rare.

Family OONOPIDAE.

[Dysderidae Cambr. List, *ad partem*.]

Cephalo-thorax of a short oval form and always more or less constricted in front, its greatest convexity is usually rather near its posterior margin, the slope being there somewhat abrupt; longitudinal stria obsolete or nearly so. *Eyes* 6, homogeneous, of the nocturnal type, large, almost equal, very closely grouped. *Ocular area* occupying almost the whole width of the caput. *Falces* conical, rather weak, considerably attenuated towards their extremities: fang slender: fang-groove without denticulations. *Labium* free. *Sternum* very large and well developed, convex, of broad-oval form, very wide and obtuse behind. *Maxillae*

rather broad at the base, attenuated towards the extremity, inclined towards the labium but never touching in front of it. *Palpus*. Female: either without a terminal claw, or else with a rudimentary one. Male: tibia of a swollen form, without apophysis; tarsus small and oval; palpal organs very simple and usually quite exposed. *Legs* of moderate length, usually nearly equal, the posterior being the longest: coxae of a swollen form, those of the fourth pair being very widely separated: femora somewhat clavate: patellae practically alike in all the legs: tibiae, metatarsi, and tarsi slender: tarsal claws 2, borne upon a small onychium. Abdomen oval. *Spinners* normal: cribellum absent. *Tube tracheal openings* very obscure: in fact I am not at all convinced that distinct apertures actually exist in all the species in this family. *Female genital aperture* simple, without special armature.

The spiders included in the family Oonopidae are all of small size. One genus, *Oonops*, is found in Britain.

Genus OONOPS, Templeton.

Spiders of a reddish tint, with soft integuments. The tibiae and metatarsal of legs I. and II. are furnished with a double series of long spines. One species only has been found in Britain, and that occurs, though rarely, in Epping Forest.

Oonops pulcher, Templeton. This species has been taken at Chingford and Theydon Bois. It is very liable to be passed over, as it has every appearance of being newly-hatched, and would therefore be easily mistaken for the young of some larger spider, *Dysdera*, for instance.

Family SCYTODIDAE.

Cephalo-thorax variable, almost almost without longitudinal stria. *Eyes* 6 (8 in one exotic genus). *Falces* more or less weak, almost cylindrical, without basal protuberance: fang short, thick at base, sharply attenuated. *Labium* rather large, longer than wide, attenuated, obtuse, usually somewhat constricted at the base, not separated from the sternum, but the line of junction is indicated by a deep impression. *Sternum* usually more or less prolonged posteriorly. *Maxillae*, strongly inclined towards labium, and convergent, wide up to the point of insertion of the palpus, then narrow and parallel-sided. *Palpus*: Female without terminal claw: Male palpal tibia without apophysis, palpal organs greatly exposed, simple in structure, but often highly developed. *Legs* long and slender, coxae almost always alike in the four pairs: tarsal claws 2 or 3 borne on a small onychium, never accompanied by claw-tufts or scopulae. *Spinners* small and closely grouped: cribellum absent. *Anal tubercle* present, but very small. *Tube tracheae* terminating in a single opening. *Female genital aperture* without special armature.

The Scytodidae are chiefly tropical and sub-tropical spiders, one genus only being represented in Britain.

Genus SCYTODES, Latreille.

Spiders with 6 eyes, arranged in three widely separated

groups, these groups forming a triangle whose apex is in front. *Scytodes* is almost invariably found in buildings of some sort. One species of the genus, *S. thoracica*, Latr. is found in Britain, but it is exceedingly rare.

Family DRASSIDAE.

[Drassidae, Cambr. List, ad partem].

Cephalo-thorax oval, never greatly convex, attenuated and obtuse in front : median stria usually present : lateral striae generally obsolete. *Eyes* 8 (in some exotic species 6 or 4) distinctly heterogeneous, the anterior centrals being of the diurnal type, and the remainder of the nocturnal type ; often oval or angular, especially the posterior centrals, arranged in two rows. *Ocular area* much broader than long. *Clypeus* narrow. *Falces* robust, usually cylindro-conical ; never greatly attenuated nor divergent ; basal prominence present ; fang rather long and powerful, somewhat enlarged at its base, *Labium* considerably longer than wide, extending beyond the middle of the maxillae. *Sternum* almost flat, oval. *Maxillae* usually more or less inclined towards the labium, marked near the centre with an oblique transverse impression (exotic exceptions) : on their interior surface there is, towards the external edge, a serrula (a row of minute pointed granulae, arranged like the teeth of a saw), and upon the internal edge a dense scopula. *Palpus* : Female, with a pectinated claw. Male, palpal tibia with an apophysis at its exterior superior angle this apophysis being usually of a very simple form : tarsus oval, completely enclosing the palpal organs, which are of rather simple structure. *Legs* fairly long and strong, almost always furnished with spines (especially in III. and IV.) : coxa and patella I. usually longer than in the remaining legs : tarsi usually with a scopula : claw-tufts present (a few exceptions) : tarsal claws 2, usually pectinate. *Abdomen* usually cylindrical, or cylindrical-oval, as a rule without brilliant colours or distinct pattern. *Spinners* prominent, usually situated quite at the posterior extremity of the abdomen : inferiors cylindrical, usually larger than the rest, well separated at the base (a few exceptions) truncated at the extremity, where there are a number of prominent spinning-tubes ; superiors with a short, conical, terminal joint, furnished with small spinning tubes. *Cribellum* absent. Tube tracheae opening just in front of spinners. *Female genital aperture* with epigynal plates, which are sometimes very small, and at other times highly developed.

The Drassidae are spiders of moderate size, which spin no snare, but usually construct silken retreats beneath stones or loose bark, seldom venturing forth in search of prey before dusk. Four genera of Drassidae are found in Britain.

TABLE OF DRASSIDAE.

- | | |
|--|-----------------|
| 1. Fang groove with, upon its inner edge, a transverse, denticulate lamina. Posterior row of eyes distinctly recurved .. | <i>Gnaphosa</i> |
| Fang groove without such a plate, usually with isolated denticulations. Posterior row of eyes straight, procurved or rarely recurved | 2 |
| 2. Maxillae externally almost straight, very little inclined towards labium, the point of insertion of the palpus | |

being not far from the base. Fang groove very oblique ;
 outer edge with three usually strong denticulations,
 inner edge with two *Drassus*

Maxillae externally convex inclined towards labium, the
 point of insertion of the palpus being near the middle.

Fang groove almost transverse, either without denticu-
 lations or with small ones 3

3. Posterior row of eyes not, or hardly longer than anterior
 row *Prothesima*

Posterior row of eyes considerably longer than anterior
 row *Phoeocedus*

Genus DRASSUS, Walck.

Spiders of elongate flattish form, somberly coloured, the
 prevailing tint being brown. Twelve species are recorded as
 British, but up to the present Epping Forest has only furnished
 specimens of four of them.

Drassus lapidosus, Walck.—Fairly common over the
 whole Forest area, under bark or loose stones, or amongst dry
 earth.

Drassus troglodytes, C. L., Koch.—A rather rare spider.
 I have taken the very distinct female near Loughton.

Drassus sylvestris, Bl.—Taken near Theydon Bois, by
 the Rev. O. P. Cambridge.

Drassus blackwallii, Thor.—An immature specimen,
 which I feel pretty sure belongs to this species, was found in an
 out-building at High Beach.

The following British species have not yet occurred in the
 Forest : *D. cupreus*, Bl., *D. pubescens*, Thor., *D. macer*, Thor.,
D. ferruginens, Bl., *D. reticulatus*, Bl., *D. minor*, Cb., *D. myticus*,
 Cb. and *D. minusculus*, L. Koch.

Genus PHOEOCEDUS, Simon.

Spiders similar to *Drassus* in many respects, but considerably
 more brilliantly coloured. One extremely rare species, *P.*
braccatus, L. Koch, has been found in Britain, but it has not
 occurred in the Forest.

Genus PROTHESIMA, L. Koch.

Spiders very similar to *Drassus* in structure and habits.
 The caput, as a rule, is rather narrower than in that genus, and
 the prevailing colour is black.

Prothesima subterranea, C. L., Koch.—A single male
 has been taken at Loughton.

The following British species of *Prosthesima* have not as yet occurred in Epping Forest : *P. longipes*, C. L. Koch, *P. nigrita*, Fabr., *P. latreillii*, C. L. Koch, *P. electa*, C. L. Koch, *P. latitans*, L. Koch, *P. lutetiana*, L. Koch, and *P. rustica*, L. Koch.

Genus GNAPHOSA, Latreille.

The spiders included in this genus are very similar in structure and colouring to *Drassus*. Four species, all more or less rare, are recorded as British, but none have been taken in the Forest. The species are as follows : *G. lugubris*, C. L. Koch, *G. lucifuga*, Walck., *G. anglica*, Cb., and *G. suspecta*, Cb.

Family CLUBIONIDAE.

[Drassidae, Cambr. List, *ad partem*.]

Cephalo-thorax oval (exotic exceptions), seldom greatly attenuated in front, where it is usually broadly truncated : longitudinal impression usually present (British and exotic exceptions) : lateral impressions usually present, but often almost obsolete. *Eyes* 8 distinctly heterogeneous, the anterior centrals of the diurnal and the remainder of the nocturnal type, arranged in two rows of which the posterior is usually the longer : the figure formed by the four central eyes is broader than long. *Ocular area* much wider than long, often occupying nearly the whole width of the caput. *Clypeus* narrow. *Falces* strong, usually vertical (British and exotic exceptions), cylindro-conical, always with a strong basal protuberance : fang long, curved : fang groove oblique with several denticulations. *Labium* free, slightly constricted laterally at base, a little attenuated, truncated or even excavated at extremity, but not recurved. *Sternum* almost flat, usually oval or cordiform. *Maxillae* flat or convex, almost always without any transverse impression, internally straight or else somewhat inclined towards the labium, externally often somewhat excavated in front of the point of insertion of the palpus, which is usually rather beyond the middle. *Palpus*. Female : with a terminal claw, which is sometimes simple and sometimes pectinate. Male : tibia with an apophysis at its superior exterior angle ; tarsus oval, enclosing the palpal organs, which are neither very complex nor highly developed. *Legs* neither very long nor very strong, varying in their relative lengths in different genera : coxae almost equal (exotic exceptions) : tarsal claws 2, strong and pectinated. *Abdomen* varying much in different genera. *Spinners* prominent, situated at the extremity of the abdomen ; inferiors close together at their bases, superiors often a little smaller than inferiors ; medians usually very much smaller than the rest. *Tube tracheal openings* not conspicuous, situated immediately in front of the spinners. *Female genital aperture* furnished with epigynal plates which in some cases are highly developed but in others are almost rudimentary.

The Clubionidae are spiders of moderate size usually of a yellow, yellowish brown or dull brown colour, in some cases with a well marked abdominal pattern, but this is the exception rather than the rule. They spin no snare, but secrete themselves in silken tubes beneath stones, under loose bark, in rolled-up

leaves and in many other similar situations. Seven genera are at present recognised as British.

TABLE OF CLUBIONIDAE.

1. Cephalo-thorax without longitudinal impression ..	2
Cephalo-thorax with a more or less distinct longitudinal impression	3
2. Fourth pair of legs longest. Tarsus of male palpus normal. Small spiders of dark colours, ornamented with brilliant metallic scales	<i>Micaria</i>
First pair of legs longest. Tarsus of male palpus rather long and pointed, with a long curved projection which is directed backwards. Spiders of moderate size and of pale colours (usually greenish yellow with reddish and yellowish markings), devoid of scales ..	<i>Chiracanthium</i>
3. Posterior row of eyes procurved	4
Posterior row of eyes recurved or straight	6
4. Legs I. and II with, on the under side, a double row of closely-set, long, strong, spines	<i>Micariosoma</i>
Legs I. and II. normal	5
5. Tarsi with scopulae. Labium much longer than wide. Posterior row of eyes very slightly procurved ..	<i>Clubiona</i>
Tarsi without scopulae. Labium as wide as long. Posterior row of eyes moderately procurved ..	<i>Agroeca</i>
6. Posterior row of eyes very strongly recurved, reminding one of the arrangement in the family Lycosidae ..	<i>Zora</i>
Posterior row of eyes slightly recurved or straight ..	<i>Liocranum</i>

Genus CLUBIONA, Latr.

Spiders usually of a yellowish or reddish yellow colour, generally without distinct abdominal patterns, (*C. compta* and *C. corticalis* are striking exceptions). The tibial apophysis of the male is very variable in form. The epigynal armature of the female is, as a rule, obscure, specimens of this sex being often very difficult to identify specifically. The genus is well represented in Epping Forest, eight out of the fifteen British species having been taken within its boundaries.

Clubiona terrestris, Westr.—Common over the whole of of the Forest, including Edmonton Marshes. It is usually found under debris and flood-refuse.

Clubiona grisea, L. Koch.—Males have occurred, but rarely, in several localities.

Clubiona reclusa, Cb.—A male taken at Theydon Bois.

Clubiona corticalis, Walck.—Not uncommon at several

localities under loose bark, but the greater part of the specimens taken are immature.

Clubiona compta, C. L. Koch.—Widespread, but apparently not common.

Clubiona pallidula, Clerck.—Under loose bark, especially that upon wooden fences. Fairly common in all parts of the district.

Clubiona brevipes, Bl.—Occasionally beaten from horn-beams, oaks, etc.

Clubiona diversa, Cb.—A single female, taken July 1902. See ESSEX NATURALIST, Vol. xiii., p. 22.

The following British species of *Clubiona* have not been taken in the Forest up to the present:—*C. lutescens*, Westr., *C. neglecta*, Cb., *C. holosericea*, De Geer., *C. subtilis*, L. Koch, *C. trivialis*, L. Koch, *C. coerulescens*, L. Koch, *C. formosa*, Templ. (a doubtful species).

Genus CHIRACANTHIUM, C. L. Koch.

The spiders of this genus are very similar to *Clubiona*, but the first leg is longer than the fourth; the falcis, especially in the male, project much farther in front, and the tarsus of the male palpus is of a form totally different from that found in the previous genus. Three species are recognised as British, of which two are found in the Forest, the remaining one *C. pennyi*, Cb., being of extreme rarity.

Chiracanthium lapidicolens, Sim. Females have been found in several localities.

Chiracanthium carnifex, Fabr. A single female at Whip's Cross.

Genus AGROECA, Westr.

The spiders included in this genus are usually of a pale warm brown colour, the thorax generally being distinctly marked with black converging lines. They bear a very strong general resemblance to some of the representatives of the family Agelenidae, but may be at once distinguished by their shorter spinners and by their possessing but two tarsal claws. The egg-sac formed by these spiders must be a familiar object to most observant naturalists. It is a goblet-shaped object, closed at the top, and composed of white silk. Some species, if not all, have a habit of covering the sac with mud, possibly as a protection against the attacks of ichneumon flies. I have found

these nests abundantly in Surrey pine-woods, but have never seen one coated with mud in such a locality—perhaps the owners were unable to find the necessary material for compounding the plaster. Although seven species of *Agroeca* are found in Britain, two only have occurred in Epping Forest.

Agroeca brunnea, Bl. I have found this species at Chingford and High Beach.

Agroeca proxima, Cb. This species occurs in several parts of the Forest.

The remaining British species are *A. celans*, Bl., *A. gracilipes*, Bl. *A. inopina*, Cb., *A. celer*, Cb. and *A. striata*, Kulcz.

Genus ZORA, C. L. Koch.

A genus of small spiders, usually of a dull yellowish colour, with dark markings. The arrangement of the eyes is very typical. Two species are recorded as British, of which one *Z. nemoralis*, Bl., has not up to the present occurred in the Forest.

Zora maculata, Bl. Occurs in several localities rather plentifully; Loughton, Theydon Bois, &c.

Genus LIOCRANUM, L. Koch.

Spiders of fairly large size, and with a distinct abdominal pattern. They bear a very considerable superficial resemblance to some species of the family *Agelenidae*. One rare species *L. domesticum*, Wid., has been found in the country, but has not occurred in Epping Forest.

Genus MICARIOSOMA, Simon.

A genus of small ant-like spiders, with fairly large eyes and a double compact row of strong spines upon the under-sides of the tibiae and metatarsi of the first and second pair of legs. The abdomen is usually clothed with iridescent scales. We have but one species in Britain, and that occurs, though not commonly, in the Forest.

Micariosoma festivum, C. L. Koch. Theydon Bois, Epping.

Genus MICARIA, C. L. Koch.

Small ant-like spiders, with small eyes, and with the body ornamented with iridescent scales, which reflect the most beautiful tints. Two species are recorded as British, but one of them, *M. scintillans*, Cb., has not occurred in Essex.

Micaria pulicaria, Sund.—Common in many parts of the Forest. Patches of herbage growing on sandy slopes are a favourite haunt with this species, and by beating such herbage with the hand, the inmates may be induced to rush out upon the sand. They may then be captured with a tube, but must not be touched with the fingers, or the beautiful abdominal scales are liable to be detached.

ERRATUM.

I find that a very obvious error has crept in upon page 185 (Vol. XII.) The two sentences commencing at the fourth line from the bottom should read thus :—
 “ Each pulpus consists primarily of six distinct joints, *Coxa*, *Trochanter*, *Femur*, *Patella*, *Tibia*, and *Tarsus*. The last five of these joints are known amongst various authors as exiguinal, humeral, cubital, radial and digital respectively ; and the first one can be satisfactorily seen only by removing the maxilla, with the palpus attached, and examining its inner surface.”

F.P.S.

[To be continued.]

ON TREE-TRUNK WATER-PIPES.

By T. V. HOLMES, F.G.S., F. Anthrop. Inst.

WHILE the Essex Field Club does not invite remarks on historical antiquities of a definite date, it has always been interested in things of a primitive kind, the use of which has been continued through many centuries into modern times, like Tree-trunk Water-pipes. And though the fragment of an old wooden water-pipe exhibited at the meeting of the Club on January 25th, 1902 (which led me to take an interest in the subject), was not found within the borders of Essex, it is obvious that appliances for the water supply of London must have been used in and around that city without any regard to the intervention of county boundaries between Middlesex and Essex.

As regards the specimen mentioned, I obtained it in the following manner. Last year (1901), Wigmore Street, Cavendish Square, in common with a large number of other places, had its road-way disturbed for the laying-down of telephone-wires. My friend, Mr. Walter Willoughby, noticed the presence in the excavations of wooden pipes, which had evidently served for the conveyance of the water supply of the district at some former period. They consisted of portions of the trunks of trees,

untrimmed, having their bark on, and each about 8ft. in length. In the centre of each log a circular channel had been bored, and one end of each length was pointed so that it might fit into the next without any escape of water at the junction. Mr. Willoughby induced the foreman in charge to cut off the pointed end of one of these pipes, and was also good enough to present the portion removed to me.

To us of the Victorian, or iron age, water-pipes of this kind naturally suggest a primitive time, such as that in which dug-out canoes abounded in the British Isles. But for knowing that these pipes were in use here when George III. was King, one might be surprised to learn that among the remains of a Roman villa at Fescote, Bucks., there was discovered, in 1840-3, a tank, containing a spring, "which ran through wooden trunks of trees to a larger tank."⁽¹⁾ Or that evidence of their existence in the Roman



FIG. 1.—SHAPE OF WOODEN WATER-PIPE.

Wigmore Street, 1901. Length about 8 feet.

(From a Sketch by *Ms. Willoughby*).

City at Silchester was discovered during the excavations in 1896.⁽²⁾ We learn also from Mr. W. H. St. John Hope, the recorder of the excavations at Silchester, that "There does not seem to be any record of such a discovery as this elsewhere in this country, but one of precisely the same kind was made in France in 1772, on the site of a Roman town at Chatelet, between St. Dizier and Joinville in Champagne." This rarity is probably due mainly to the comparative rapidity with which wooden pipes would tend to perish, if close to the surface; while, if deeper, they would be proportionately the more likely to escape the notice of the explorer.

However, the interest attached to the discovery of primitive water-pipes increases with the lateness, not the antiquity, of the period to which they can be ascribed. Passing therefore over a considerable interval of time, I learn from the *History of London*

(1) *Genl. Mag. Library, Romano-British Remains. Part I., p. 8.*

(2) *Archæologia. Second Series, Vol. V., pp. 422-3. (1897).*

by William Maitland, F.R.S., and others, published in 1756, that when in the time of James 1st there was a demand for additional water supply, which led to the formation of the New River by Sir Hugh Middleton (1609-13), the water thus brought to Islington was there "engulph'd by fifty-eight large wooden pipes." These pipes were each of a seven inch bore. Maitland mentions the places from which water had been brought for the supply of London :—

"From London Bridge eight main pipes of a seven inch bore ; from Hampstead and Highgate two mains of seven inches ; from St. Mary-le-bone two mains of seven inches ; from Hyde Park three mains of six inches ; from Chelsea five mains, viz., one of six, three of seven, and one of eight inches." We are also informed that these main pipes "are branched out into a vast number of smaller pipes, which convey the water through all parts of the City and Suburbs ; into the houses of which it is carried by small leaden pipes."

It is evident that this fragment of a pipe from Wigmore Street did not belong to a main, as the diameter of its channel is only about three inches. Mr. Willoughby tells me that similar pipes of larger bore were seen crossing at right angles those lying along Wigmore Street. It is of course impossible to say whether these pipes are those which were laid down when Wigmore Street, Cavendish Square and other streets adjacent were built, or not. These streets seem to have been built between the years 1720 and 1740, and are shown on Rocque's *Map of London and its environs*, made between the years 1741-5.

In *Rees' Cyclopædia* (London 1819) wooden waterpipes are said to have been usually made of elm or alder ; oak, though otherwise preferable being much more difficult to bore, and consequently more expensive. The defects of wooden pipes are said to be their want of strength to resist pressure and their liability to decay at the joints. A patent taken out in 1806 for improved wooden water pipes had not been a success ; and we learn that, "within these few years past," the great London water companies had adopted cast-iron pipes for their mains, and were daily increasing their numbers, though popular prejudice was at first strongly excited against iron, as being likely to give the water a metallic flavour, which would be injurious to health.

Our Secretary, Mr. W. Cole, having suggested to me that our member, Mr. H. G. Morris, of the Kent Water Company, probably knew something about these wooden pipes, I applied to that gentleman, and he was good enough to favour me with the

following details about them. Tree-trunk pipes were used by the Kent Water Company about 100 years ago in Deptford and Greenwich, when the pumps were worked by a water-wheel at Mill Lane, Deptford. The water was supplied at a low pressure on the ground floors of the houses. Mr. Morris adds that old wooden pipes have been dug up when excavations have been made for sewers, or for new water-mains, in High Street and other parts of old Deptford, also in London Street, Stockwell Street and Church Street, Greenwich. He distinctly remembers seeing old wooden pipes in the pipe yard at the Kent Water Works, Deptford, when he was a boy; and remarks that the Kent Water Company sent several wooden water pipes to the "Healtheries" Exhibition at South Kensington a few years ago.

Mr. Cole also reminded me that another member of the Essex Field Club, Mr. J. M. Wood, C.E., of the New River Company, might know something of these tree-trunk pipes. On writing to Mr. Wood about them he kindly invited me to visit the Office of the New River Company—the oldest of the London Water Companies—and he there showed me some of the old wooden pipes, together with many other objects of interest in connection with the water-supply of London. The pipes seen were all of elm; and Mr. Wood pointed out a kind of iron band which had been driven into the pipes at the non-tapering end, between the outer bark and the inner channel, to make the joints fit the more tightly. He stated that wooden pipes were in use by the London Water Companies till 1808 or 1809, when iron pipes were introduced.

As regards the New River Company's store of wooden pipes a century ago, the following details will be of interest. In *Old and New London*, vol. 2, p. 303, are these remarks on a part of the Clerkenwell District:—

"The Ducking-Pond Fields, Clerkenwell Fields, Spa Fields, and Pipe Fields, were one and the same place under different names. The oldest of these names was the first, which applied especially to the district surrounding Spa Fields Chapel, and extending to the northward. The Pipe Fields were so called from the wooden pipes (merely elm trees perforated) of the New River Company, mentioned by Britton about the close of last [18th] century."

Britton remarks in his *Autobiography*³ that Clerkenwell, when he first knew it in 1787, was very different from what it was in 1850. At the earlier date:—

"Spa Fields, from the south end of Rosoman Street to Pentonville, from St.

³Quoted in Wheatley's *London Past and Present*, vol. 1. (Clerkenwell.)

John Street Road to the Bagnigge Wells Road were really fields devoted to the pasturage of cows, and to a forest of elm trees; not standing and adorned with foliage in the summer, but lying on the ground to the southward of the new river Head, being destined to convey water in their hollow trunks to the northern and western parts of London in combination with similar pipes laid under the roadways of the streets."

I am also indebted to the kindness of Mr. C. F. Marsh, of the East London Water Company, for the information that cast iron pipes were first laid down by that company about the year 1808, though wooden pipes were probably used several years after that date, when channels of the smaller sizes were required. He adds that the use of bored wooden pipes has been recently revived in parts of the United States where timber is cheap. They are somewhat less rudely made than the older specimens, and are surrounded by spiral bands of steel.

The subterranean position usually occupied by these water-pipes has almost entirely prevented them being shown in pictures and engravings of the periods during which they were used. My son Walter, however, has reminded me that a wooden water-pipe appears in Hogarth's picture "Evening" (1738).

Nor are they common (so far as I know) in museums. There is one in the Guildhall Museum, among the other local antiquities there, described as an "Ancient Water-Pipe for supplying the City Conduits." It is between five and six feet long. And the late Frank Buckland mentions one in the Museum at Oxford (*Curiosities of Natural History* 2nd Ser. Chap. I.) in the following terms:—

"In the same Museum is suspended against the wall what at first sight appears to be a wooden pipe, but upon examination it will be seen to be not a wooden, but a stone one; it is a stone pipe formed within a wooden one. The original pipe, about four inches square, belonged to the old conduit at Carfax in Oxford; in process of time the carbonate of lime had formed equally on all four sides of the pipe to the thickness of about a quarter of an inch. When taken up the woodwork was found to be quite decayed, but nevertheless it did not leak, as there was another pipe within it, firmer, more solid, and more lasting than the wooden one, through which the water flowed; this second pipe is of stone, naturally formed within the first. On examining our stone specimen we find that the inside is smooth, but the outside, on the contrary, is quite rough preserving accurately the lines of the rough fibre of the oak from which the wooden pipe was made, and in one place a mark, very like a saw mark, can be traced."

Doubtless a similar deposit has preserved the efficiency of

many other wooden pipes long after they would otherwise have become useless. Buckland adds in a note :—

“I learn that the fashion of pollarding, or cutting off the branches of elm trees in the neighbourhood to make them grow tall and straight, arose from the former demand for their stems, cut into lengths, and bored throughout to make pipes to conduct water. I have frequently seen these in the London streets when the workmen have been making excavations for repairs.”

[Mr. J. M. Wood has presented a fine specimen of a wooden water-main, formerly employed by the New River Company, to the Epping Forest Museum, a drawing of which is given (Fig. 2). It is an elm trunk 9ft. 7in. in length, 6ft. in circumference at the larger, and 2ft. 3in. at the smaller end. The trunk has been tapered at one foot from the end, and the diameter at that end is 7 inches; at the larger end 10 inches; so that two similar pipes could be easily fitted together. At the larger end an iron ring

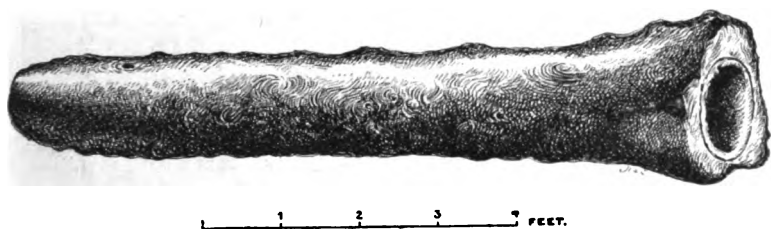


FIG. 2.—WATER-PIPE MADE FROM AN ELM TRUNK.

New River Company.

Now in Epping Forest Museum.

has been inserted in the wood, so as to prevent splitting when another pipe was wedged in. The bore is very straight, and very perfectly circular in section, making allowances for the natural decay of the wood. It is a matter of curious conjecture how such long and perfect “bores” in a solid tree-trunk could have been made. We have been assured by an engineer that even now, with the aid of steam power, such drilling would be difficult, and in pre-steam days much more so. At present we have no information on this point—Ed.]

Tree-trunk pipes, being both ancient and modern appliances, when seen, being exposed by accident, not by design, and being invisible, when in use, have attracted scarcely any attention from archæologists. I found, however, in the *Journal of the British Archæological Association* for 1873 (Vol. 29, pp. 184--186)

some brief notes "On Ancient Water Pipes" by Mr. H. Syer Cuming, in which the following passage occurs:—

"The Romans, like ourselves, employed three materials in the manufacture of their ordinary piping for the conveyance of water, namely wood, earthenware, and metal. Pliny (XVI.-42) records that the pine, fir, and alder were wrought into water pipes, and that when bedded in the earth they lasted for many years, and that their resistance to decay was greatly increased if the outside of the stem was left in contact with the water. I have seen a few examples of hollowed trunks of trees which have been exhumed in London from depths which would favour the idea that they were of Roman or Roman-British origin, though there was no direct evidence to fix the period. The Treenpipes found near the Mansion House, within a year or two, were unquestionably of very ancient date."

Most of Mr. Syer Cuming's remarks are on bamboo, terra cotta, lead and leather pipes. But he adds:—

"There are yet points in the history of these conduits which it would be well to learn a little respecting, as for instance, when was the folded tube of lead superseded by one cast as a cylinder, and when was the huge Treen pipe abandoned for one of iron."

He also remarks in a note, p. 186 :—

"I have been told that iron water pipes began to be laid down in London about forty years since. The old elm tree pipes were removed from Pall Mall about the year 1860, and in part of Piccadilly they remained in use till 1864."

Of course the difficulty is to make sure that the pipes were *in use*, and not merely *in place*, in 1864.

On searching *Notes and Queries*, I could find nothing about wooden water pipes previous to 1899. But in the number for June 10, 1899, there is the following paragraph from the *Daily Telegraph* of May 8th, 1899 :—

"Ancient Water-Pipes.—During the progress of some excavations along Oxford Street, east of Marble Arch, the workmen recently came upon quite a number of the ancient wooden pipes formerly used to convey water through the streets of London. They consist of small elm trees, usually about ten or twelve inches in diameter, cut into six or seven feet lengths, and were laid down in the early days of the New River Water Company. . . . Elm was used as it was found to resist the pressure of the water better than any other cheap timber, and was less liable to decay. The pipes were of the rudest construction, being simply the trees denuded of their bark and bored with a hole six inches in diameter. One end of each length was tapered to fit into the slightly widened bore of the length laid before it, and a few blows of a wooden mallet served to fix it into its place. The pipes were very troublesome. They were liable to burst during frosts, they leaked considerably, and they had to be frequently renewed. Nearly four hundred miles of them were laid in London, and as it was not worth the trouble to take them up when they were gradually replaced by metal pipes, there must be many scores of miles of them still underground.

In the same number of *Notes and Queries*, Mr. Edward Peacock, of Kirton-in-Lindsey, remarks that :—

“London was not the only place where water was conveyed in wooden pipes. They were used in Hull, I am not sure of the exact date, but I think they were taken up in that town and their place supplied by iron tubes somewhere about seventy years ago. A Mr. William Hall, who had been Mayor of Hull, procured some of them for the purpose of using them as drains under the gatesteads on his property at Bottesford and Yaddletorpe near here. They were fashioned like those of London as above described. I cannot be sure of what kind of wood they were made.”

In *Notes and Queries* for July 1st, 1899, Mr. Richard Welford, asks:—“Were not wooden pipes for the conveyance of water used almost everywhere in the seventeenth century.” He then mentions the construction of a reservoir at Coxlodge and the laying down of a four-inch wooden pipe, in 1697, for the supply of Newcastle-on-Tyne. Other wooden pipes are mentioned, the trees employed being elm. Mr. Welford adds that sometimes the old elm woodpipes are exhumed in making excavations, one having been dug up near the Tyne Theatre, Newcastle, in August 1893. He thus concludes by saying :—“Much curious information upon this subject is contained in a pamphlet entitled *History of the Water Supply of Newcastle-on-Tyne, 1851.*”

Mr. John Robinson (*Notes and Queries*, same page) says that these wooden pipes are often dug up at Newcastle-on-Tyne when gas pipes are laid down, and that “they are usually about 2ft. long, 10 inches in diameter, and of a 3-inch bore. Many of the oak pipes are as solid as when first put down.”

I am indebted to my cousin, Miss E. Graham, for calling my attention to the *Newcastle Weekly Chronicle* of Oct. 4, 1902, which contains a sketch of a tree-trunk water-pipe dug up in Newcastle this autumn.

The following case illustrates the difficulty of getting information about tree-trunk water-pipes from local histories. In the *Hand-book to Newcastle-on-Tyne* by the late Dr. J. Collingwood Bruce, published in 1863, we have a work second to none of its class, whether for varied learning or general attractiveness. Dr. Bruce by no means confines himself to Roman or mediæval antiquities, but gives much information as to the ways and customs of Newcastle people during the eighteenth and the early part of the nineteenth centuries. But though, *inter alia*, we learn from him that “at the beginning of this (19th) century,

and for more than ten years afterwards, all the bricklayers' labourers were women ;" and that, "in 1822 a bull was baited on Cullercoats sands," the only remark on water supply is this:—"Until a comparatively recent period the great proportion of the inhabitants of Newcastle were dependent for their daily supply of water upon the public pants."⁴

The Times of August 1st, 1902, announced that the laying of new gas-mains in Finsbury Pavement had been the cause of "an interesting discovery in the shape of old trunks of trees which were in old times laid as water conduits." They were well preserved, about 4ft. beneath the surface, and some of them were 20ft. or more in length, having been "hollowed out to a bore of 6in. or 8in.," &c. As to their antiquity, we learn that "there is an opinion that they must have been 150 years in the ground."

I visited Finsbury Pavement on August 1st, and saw some of the pipes mentioned in *The Times*. Most of the bark was gone, but from what remained the trees were evidently elm. Somewhat later in the same day I saw an excavation in Oxendon Street, on the eastern side of the Comedy Theatre, between Leicester Square and the Haymarket. A portion of an old tree-trunk pipe had been removed, and another could be seen in place. Its upper surface was not more than 18 inches below the level of the street. But, as might be expected in the case of a narrow street which had never been a main thoroughfare, the pipes had a much smaller channel than those of Finsbury Pavement. And on August 6th, I saw a wooden water pipe resembling those of Oxendon Street, which had just been removed from an excavation in Whitcomb Street, between Oxendon Street and Leicester Square. Both these streets are shown on Rocque's Map (1741-5).

I am indebted to Mr. Cole for the following paragraph from the (London) *Daily Chronicle*, of Sept. 23, 1902:—

"TREE-TRUNK WATER-PIPES.—Bond Street, among both its old and new sections, is now littered with decayed and hollow tree-trunks. These have been unearthed in the process of laying a new water-main, and are said to have reposed 350 years below the roadway. At one time they served to carry the water supply to St. James's Palace, and as their diametrical measurement is about 10in., no reasonable complaint could have been sustained in the past against their carrying capacity. Each length is about 6ft. to 8ft. of roughly-trimmed tree-trunk, with one end tapered to insert in the butt end of another."

⁴Small street reservoirs.

On Sept. 24th I saw in New Bond Street ten or twelve lengths of tree-trunk piping, which had been brought to the surface. Most of the pipes were from seven to eight feet long, but two were about twelve feet. The bark was largely worn away, and all were of elm. The longer pipes were evidently portions of tall, straight trees, which had been without side branches of any size, while the shorter pipes were portions of less straight stems of more variable girth, which showed signs of large lateral branches. Consequently the thickness of wood enveloping the channel varied very much more in the shorter pipes than in the longer ones. A practical difficulty in measuring the diameter of a pipe-channel arises from the fact that the tapering end of the pipe is usually much decayed, while the other end, which looks little the worse for age, has been enlarged to admit a portion of the tapering end of the next pipe. This, no doubt, accounts for the statement in the *Daily Chronicle* that the diameter of the channel was about 10 inches. For a pipe that had been sawn in two showed a bore of 7 inches.

As to the antiquity of the street (through not necessarily of the pipes), we learn from *Old and New London* (Vol. iv., p. 298):—

"In 1700," says Pennant, "Bond Street was built no further than the West end of Clifford Street. New Bond Street was at that time an open field called the Conduit Mead, from one of the conduits which supplied this part of the town with water."

In *Notes and Queries* (9th series, vol. iv. 1899), there are some notes on the word "howl" and its derivation. The "howl" in question appears to mean "a wooden waterway under a road," and to be "in constant use by the Trent and the Ancholme," the latter being a stream flowing through north Lincolnshire into the Humber. One correspondent on this subject remarks that the alder was the tree formerly used for wooden pipes; and that in Lancashire the word used is *owler* or *howler*. Another ("S. Arnott, Ealing," p. 132) says:—

"Howl" (p. 49 and 93). I heard this word, or its equivalent, used in Essex, on the borders of Hainault Forest. I was accompanied by a friend observant of such matters, and we certainly supposed it began with the letter *v*, as if it were *vole* or *voule*. It was applied, as your correspondents state, to a wooden waterway under a road."

Though, as we have seen, tree trunk water-pipes were used in Newcastle-on-Tyne, the word *howl* appears in Mr. R. O.

Heslop's *Northumberland Words*⁵ simply as meaning *empty*. But whatever may be the local variations in spelling, it is interesting to find the thing indicated in use alike in Lancashire, Lincolnshire, and Essex.

We have seen that iron main pipes began to supersede wooden ones in the London district about the years 1808 and 1809. But, except possibly in the iron-producing districts, it is highly improbable that this was commonly the case in our towns before the general diffusion of railways. London, of course, always had the advantage of being a great port, and navigable rivers and canals may often have afforded a means of transit for iron pipes a century ago, from manufacturing to agricultural districts. But many large areas would then be far removed from water communications, which would allow of the importation of iron pipes at a paying price. And the popular prejudice against their introduction would be probably stronger in rural districts than (as we have seen) it was in London.

Another set of circumstances, however, materially reduces our chances of finding evidence of the use of tree-trunk pipes in our smaller towns after they had fallen into disuse in London, Hull, and Newcastle-on-Tyne. For in the first half of the nineteenth century the great majority of the smaller towns were content to obtain their water supply from the sandy or gravelly sites on which they stood, by means of pumps or shallow wells. Consequently when the spread of cholera and other diseases revealed the danger of using this water, and a more deeply-seated or distant supply was obtained, the pipes distributing it would naturally be of iron. For by that period the former use of wooden pipes would be recalled only by a few of the older inhabitants as a vague tradition of the olden time; no actual instance of their employment being known in the immediate neighbourhood.

In illustration of the fact that our older towns and villages are usually to be found on sandy or gravelly soils, so as to obtain their water supply from pumps or shallow wells, and thus be beyond the need for water pipes of any kind, let us consider the district occupied by the so-called "Hastings Beds" of Kent and Sussex, where the clayey and sandy beds occupy nearly equal areas of the surface. Topley, in his *Geological Survey Memoir*

⁵Published for English Dialect Society, Lond., Keegan, Paul and Co., 1892.

on the Weald, remarks, p. 396, that on these Hastings Beds there are 97 towns and villages, 79 of which have sandy sites. Careful inspection of the "drift" maps of Essex discloses a similar preference for sandy or gravelly sites in that county.

From the *Sixth [and final] Report of the Rivers Pollution Commission*, a Blue-Book published in 1874, we learn that even at that date a very large number of our smaller towns were dependent on pumps and shallow wells. Essex not being a manufacturing district, and most of the county being outside the Thames Basin, five only of its towns and districts are mentioned where the nature of the local water supply is given. Wanstead was then supplied by the East London Company; Leigh depended upon shallow wells. Braintree Waterworks are mentioned, but not their date. At Harwich a borehole was then being made in the Chalk. And at Sudbury the supply had been from shallow wells in 1870, but the Corporation had just carried out waterworks. In this Blue-Book the nature of the pipes in local use is scarcely ever mentioned.

But there is a short chapter "On the deterioration of potable water by transmission through mains and service pipes." In this chapter there is no mention of wooden pipes, the subjects discussed being the "Injury to the potable waters by cast iron mains"; the "Injury to water by the improper construction of the joints of the mains"; and the "Injury to potable waters by leaden service pipes." As regards the iron mains, the injury to the water was caused by the rusting of the iron. We learn, however, that by "a simple method *having the sanction of more than 20 years' experience* this corrosion and its consequences can be prevented." Details of the process are then given.

As this Blue-Book was (as already remarked) published in 1874, it becomes clear that in the first half of the last century there were more solid objections to the use of iron mains than those which were merely the result of prejudice. But the early defects of iron pipes exercised an influence not in causing any revival of wooden ones, but in retarding the formation of local waterworks, and the disuse of pumps and shallow wells.

In this Blue-book there is a chapter on "The Propagation of Typhoid Fever by Water." Among the places mentioned as having suffered from outbreaks of typhoid fever are Page Green, south of Tottenham (1864 and 1865), Terling (1867), and

Wicken Bonant, near Saffron Walden, in 1869. In each case the mischief was clearly shown to be traceable to a water supply from shallow wells in the gravel on which the houses stood. At Terling some water was also obtained from the Ter where it flowed through the village; and at Page Green Waterworks supplied some of the houses. But the shallow-well water was evidently the most popular at Page Green, and we are told that the inhabitants were surprised to find that it was supposed to have anything injurious in it, "and amused at its being analysed." This popular preference for shallow-well water to that from waterworks, in a London suburb, in the year 1865, enables us to realise the still stronger feelings of the same kind which must have prevailed in rural districts up to that time, and have tended to prevent any considerable use of wooden water-pipes in small country towns after their disuse in London and other great centres of population.

Essex is a county in which we might expect to find a special abundance of survivals of old wooden appliances of all kinds. It is one of the most uniformly well-wooded of districts, has many wooden village spires, abounds with wooden houses, and has (as Matthew Arnold notes in his *Letters*) an "ancient" look generally. Finding that Chelmsford, though on a gravelly site, was in 1771 using pipes to convey water from the Burgess Well to the Conduit in the Market Place, I wrote to Mr. F. Chancellor, F.R.I.B.A., &c., asking him if they were, or, so far as he knew, ever had been, of wood. However, he was good enough to inform me that as the supply came from a spring only 650 yards away, the pipe was of lead. He was well aware of the former use of tree-trunk pipes, and remembered seeing many disinterred some years ago in Bishopsgate Street, when a new iron main was being laid; at the time when the Great Eastern Terminus was at Shoreditch. But, as regards Essex, Mr. Chancellor replied:—"I never remember seeing anything of the kind in the county; the nearest approach to it is the old Tree-Pump, which used to be very common in this county, and I daresay there may be one or two left."

Though, from one point of view, tree-pumps and tree-pipes are things which might naturally be expected to flourish together in the same district, from another they tend rather to be mutually exclusive. For where the water supply of town or village is

obtained by means of pumps and shallow wells, tree-pumps may abound, but there will be no demand for tree-pipes to bring water from a distance.

It will be remembered that in the *Sixth Report of the Rivers Pollution Commission* (1874), Harwich was mentioned as a place where an attempt was then being made to supply the town with water from a bore hole driven into the Chalk. Though not a large town, Harwich is one of the most ancient of our ports. It happens also to be one of the extremely few places in Essex of which the nature of the water supply is noted in Morant (1768), Vol. 1., p. 499. There we learn that the inhabitants, "besides what they save from rain in cisterns, in a drought are forced to have water fetched in water carts from a spring near a mile from the town by the road to Dovercourt; or to have it brought in boats or scoots from a fine spring at Landguard fort, or from a spring at Arwarton in Suffolk, which they had by permission from Sir Philip Barker, Bart., lord of the soil."

Of Landguard Fort it is stated (p. 502) "It is supplied with fresh water by pipes under ground from Walton Colnesse." The nature of the pipes is not mentioned.

Turning to the *History of Essex* by Wright (1830-40), I see but the following remark bearing upon water-supply. It refers to Colchester (vol. i. p. 339):—"When Windmill field, adjoining to Chiswell meadow was let by the Corporation in 1620, to Thomas Thurston, one of the aldermen, liberty was reserved to lay pipes, or trunks, for the conveying of the water from Chiswell meadow." Here it is evident that we get the interesting allusion to "pipes or trunks" simply because these words occur in a legal document defining the rights reserved to themselves or granted to an alderman by the Corporation of Colchester, and not to illustrate the way in which the water is to be conveyed. We learn nothing from Wright as to the date about which *pipes* and *trunks* began to be not necessarily identical at Colchester. Nor is anything to be gathered on that head from the *History of Colchester* by Thomas Cromwell (London and Colchester, 1825), who states that "the present Waterworks" are a revival of the ancient plan of conveying water from Chiswell Meadow, the steam engine being introduced. But the nature of the pipes is not mentioned.

Nevertheless, Colchester, from its use of tree-trunk pipes for

centuries before the introduction of iron ones, from its comparatively slow growth, and its position in an agricultural district far from the iron-producing parts of England, seems likely to have used wooden pipes many years after they were superseded in such places as London, Hull, and Newcastle-on-Tyne. Feeling this, I wrote to Mr. H. Laver, F.S.A., etc., asking him if he could give me any information on this point. He very kindly endeavoured to ascertain the date of the change from wood to iron, but without success. When the Corporation at Colchester took over the management of the Waterworks, they do not appear to have preserved the various documents of the Water Company preceding them to the degree necessary for the settlement of this question. Thus, in the case of Colchester, we learn by accident of the use there of tree-trunk pipes in 1620, but, on the other hand, accident has prevented us from ascertaining whether they were still employed in the earlier years of the reign of Queen Victoria. However, it is the impossibility of knowing where any evidence of the late survival of these pipes may exist, that makes the collection of what is available desirable.

We have seen that a chief defect of tree-trunk pipes was their liability to decay at the joints. A result of this, says the writer in *Rees' Cyclopædia*, is that "the pavement of the streets is constantly broken up, the way impeded, and the supply of water suspended." The streets of London, as most of us know, have been more blocked than usual since the beginning of the present century, by excavations for various purposes. It is somewhat amusing to find that Londoners a century ago must have had little, if any, advantage over us in this respect. If the total amount of the traffic then was much less than at present, it was much more concentrated in a limited number of streets. And the streets then, as now, most subject to excavations, must have been the chief business streets, which would need repairs much oftener than the others. As a dug-out canoe, carried down by a flood and buried in silt, may be preserved for centuries if allowed to remain undisturbed under the same conditions, yet rot speedily if they are much varied; so with tree-trunk water-pipes beneath a street. Those beneath the busy thoroughfares, which were frequently needing repairs, might rot from ten to fifty times as fast as those under quiet streets but a few yards away.

APPENDIX.

Mr. B. G. Cole has been good enough to send me the following extracts bearing upon the question of water-pipes, from Baker's *Chronicle of the Kings of England*. London, MDCLXV. :—

"In his [King Henry VIII.'s] thirtieth year (1538-9) the manner of casting Pipes of Lead for conveyance of water under ground, without using of Soder, was first invented by *Robert Brocke*, Clerk, one of the King's Chaplains, a profitable Invention; for by this, two men and a boy will do more in one day than could have been done before by many men in many days: *Robert Cooper*, Goldsmith, was the first that made the Instruments, and put this invention in practice."

1612-14. "About this time a memorable Act was performed by Mr. *Hugh Middleton*, Citizen and Goldsmith, of *London*, and born in Denbighshire, who having an Act of Parliament for his Warrant, with infinite cost and indefatigable labour, brought Water to the City of *London*, from two great Springs of *Chadwell* and *Ainwell*, in Hertfordshire, having cut a Channel from thence to a place near *Islington*, whither he conveyed it to a large Pond, and from thence in Pipes of young Elms to all places of the City."

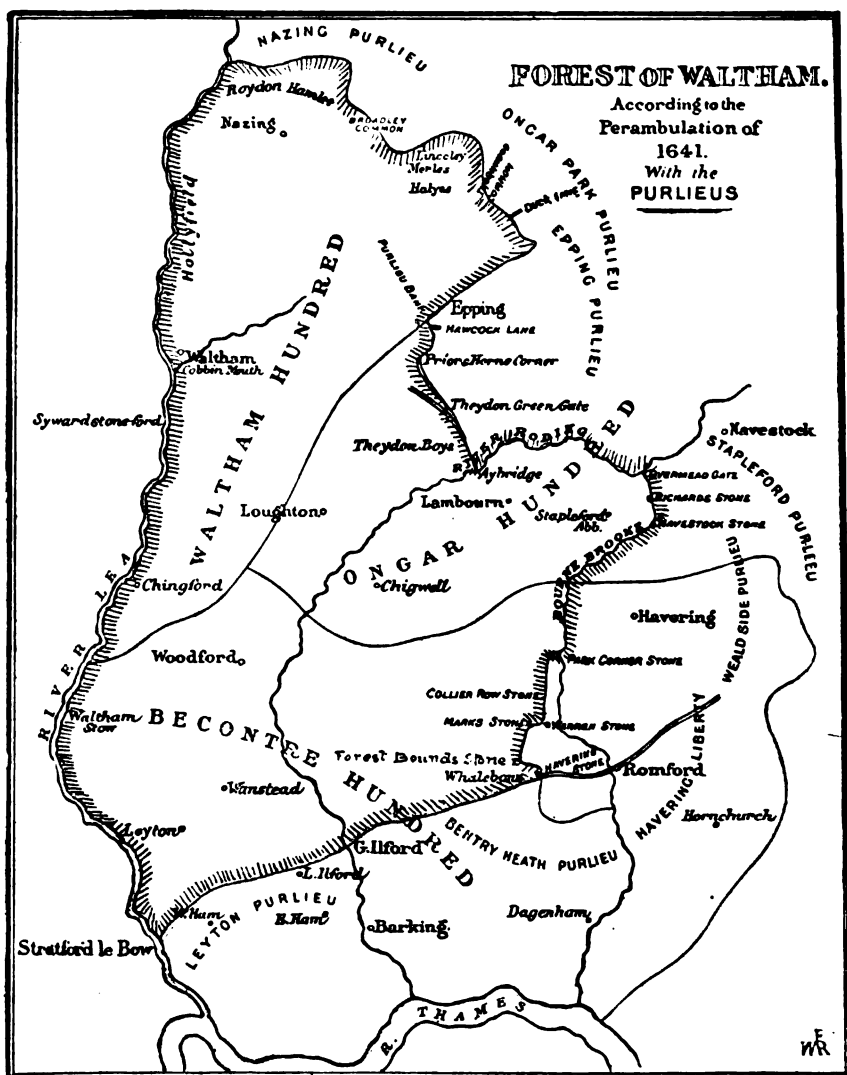
In the *Illustrated London News* volume for the second half of the year 1856 there is an article on the New River Water Works (pp. 521-3). It is there stated that the Service Reservoir in Claremont Square was originally called the High Pond, and that "in excavating for the new reservoir, some curious remains of the old system of wooden piping and plugs were found embedded in the mud, and were the contrivances by which the water was let out of the pond many years since."

THE LIMITS OF THE OLD FOREST OF WALTHAM FOR FAUNISTIC PURPOSES.

By W. COLE.

(With Sketch-Map.)

IN my paper on "Area of Epping Forest for Faunistic Purposes" (ESSEX NAT., vi. 10) I considered only that portion of Waltham Forest which is commonly called "Epping Forest," and the accompanying map was so delimited. But when engaged in settling the extent of the collections for the Forest Museum, I decided to include the whole of the Forest of Waltham as set out in the last Perambulation (that of the 17th year of Charles I., 1641) as an excellent basis for collecting operations. This district includes the site of Hainhault, and



SKETCH-MAP OF THE OLD FOREST OF WALTHAM,
As defined by the perambulation of 1641. The Forest Boundaries are outlined with
short dashes.

(From Fisher's "Forest of Essex," with additions).

comprises some 60,000 acres. The limits of the whole Forest were laid down in the perambulation, which was reprinted in the article referred to (E. N. vi. 12-16), and were roughly indicated on a sketch-map prepared for Professor Meldola's paper on the Forest Stones and the little *Museum Leaflet*, published in 1895. Now that a considerable portion of old Hainhault Forest has been secured as a reserve open space, which it is hoped will rapidly reassume a forestal character, it will be convenient to take the ancient Forest of Waltham as the area for faunistic papers and records. I therefore reproduce here, for the benefit of new members and contributors, the sketch-map alluded to above. The bounds of Hainhault as distinct from Epping are on the western side of the River Roding to Park Corner Stone, then by the margin of the Bourne Brook to the stone "sculptured and named Richard's Stone, and from thence by the hedge of the land of Robert Makin leading direct to the gate called Overmead Gate," and thence westward (forming the northern boundary) "unto the bridge of Aybridge, otherwise Assbridge," where the boundaries of Epping Forest are met (see perambulation at pages 13-14, *loc. cit.*). The eastern boundary stones of Waltham Forest were described in Professor Meldola's interesting paper in E. N. ix., 1-10, with drawings of six of them by Mr. H. A. Cole. Now that special attention is being directed to Hainhault we may hope to have many records and lists from the ancient forest lands.

NOTES ON SECTIONS IN THE LEA VALLEY AT CANNING TOWN.

By A. S. KENNARD and B. B. WOODWARD, F.L.S., F.G.S.

[*Read April 4th, 1903.*]

SINCE there are no permanent sections in the Lea Alluvium and the growth of London threatens soon to cover it with buildings, it is of the greatest importance to observe such chance excavations as are made from time to time during building operations. In 1901 additions were made to the Paragon Printing Works, Ford Park, Canning Town, and some interesting sections were exposed.

In these modern alluvial deposits there are always minor

differences in the details, the beds varying in thickness in a distance of a few yards. The general section was as follows :—

1. Surface soil and clay, 3 feet.
2. Carbonaceous silt, 5 to 11 feet.
3. Pleistocene gravel. Thickness unknown.

This section, it will be noted, is almost identical with many of those exposed in the excavations in the new reservoirs at Walthamstow, the three divisions being constant.¹ The top layer contained no fossils, and in our opinion represents the result of the repeated floods of the river since it was confined within banks and the marshes drained.

The carbonaceous silt was a stiff black clay, full of vegetable matter, and extremely difficult to wash.

The vegetable remains were so decayed that it was almost impossible to determine any forms, but remains of the elm were common. Lenticular patches of moss, often in the condition of peat, occurred throughout, the patches being sometimes three feet in diameter, with a maximum thickness of eight inches. Leaves of the flag (*Iris pseudacorus*) were very common and well preserved.

Molluscan remains were scarce, and occurred in patches at from 7 to 11 feet from the surface.

The only vertebrate fossil was a portion of the horn core of a sheep, *Ovis aries* (Linn).

We have determined the following species of mollusca :—

Hygromia hispida (Linn).

Vallonia pulchella (Müll).

Helix nemoralis (Linn).

Limnæa pereger (Müll).

„ *palustris* (Müll).

„ *truncatula* (Müll).

Planorbis umbilicatus, Müll.

„ *carinatus*, Müll.

„ *vortex* (Linn).

„ *fontanus* (Lightf).

Bithynia tentaculata (Linn).

„ *leachii* (Shepp).

Valvata cristata, Müll.

Vivipara vivipara (Linn).

¹T. V. Holmes, "Geological Notes on the new Reservoirs in the Valley of the Lea near Walthamstow."—*ESSEX NATURALIST*, Vol. xii., pp. 1-16.

Although a small list, three species, *Planorbis carinatus*, *P. fontanus* and *Bithynia leachii*, are unrecorded for this part of the Lea Alluvium though it should be noted that only one other series has been obtained.²

All these forms are known from the Lea Alluvium at Walthamstow, and are all univalves, a fact which, taken in conjunction with their method of occurrence, lends great support to the view that they did not live where they were found, but are drifted shells. The gravel beneath the silt is undoubtedly of Pleistocene age, and, in our opinion, represents a late stage of that period when the land stood at a slightly higher altitude relatively to the sea. This third terrace, as it has been called, is as a rule unfossiliferous, though three species of mammalia were found in it at Walthamstow in 1869, viz.: *Elephas primigenius*, Blum. *Bos primigenius* Boj. and *Cervus strongyloceros* Owen³. The last named is allied to the Red-deer, though much larger. In the adjoining Thames Valley a fairly large fauna has been found in the "Third Terrace." Flint implements have been found occasionally in the Lea gravel, but all are much abraded and rolled, and are undoubtedly derived from higher levels, probably the High Terrace. In all likelihood it is the higher level gravels that have furnished the materials of which it is composed.

The water level in the excavations was constant at 8 feet 6 inches from the surface, and great difficulty was experienced in keeping the excavations dry. The enormous quantity of water present may be gauged by the fact that from the hole sunk for the engine bed 10 feet by 14 feet and 14 feet deep, no less than 6,000 gallons per hour were pumped.

We have to tender our best thanks to Mr. A. Kennard for a knowledge of the sections, and it is entirely owing to the interest and trouble that he took whilst the excavations were in progress that this paper owes its existence.

²A. S. Kinnard and B. B. Woodward "The Post-Pliocene Non-Marine Mollusca of Essex."—*Essex Nat.*, Vol. x. (1897) p. 91 and Table.

³Woodward, Henry "The ancient Fauna of Essex," *Trans. Essex Field Club*, vol. iii., p. 7

NOTE ON THE OCCURRENCE OF FRESH-WATER MOLLUSCA IN A WATER-MAIN AT POPLAR.

By A. S. KENNARD and B. B. WOODWARD, F.L.S., F.G.S.

[Read April 4th, 1903.]

IT has long been known that fresh water mollusca are able to accommodate themselves to the artificial conditions of underground water-pipes, but hitherto only three species, *Dreissensia polymorpha* (Pall.), *Neritina fluviatilis* (Linn.), and a *Limnæa* have been recorded.¹ Of these the first-named has been found in London, Manchester, and Birmingham, while the two latter occurred in London. Recently Dr. Frank Corner, F.G.S., forwarded to us some material which had been obtained from a disused iron water-main in Poplar. On examining it we were able to identify no less than eleven species of mollusca:—

Ancylus fluviatilis, Müll.
Velletia lacustris (Linn.)
Limnæa pereger (Müll.)
Planorbis crista (Linn.)
 „ *albus*, Müll.
Neritina fluviatilis (Linn.)
Bithynia tentaculata (Linn.)
 „ *leachii* (Shepp).
Dreissensia polymorpha (Pall.)
Sphaerium corneum (Linn.)
Pisidium subtruncatum, Malm.

From the numbers there can be no doubt that these species had thoroughly established themselves in such apparently uncongenial surroundings. The most abundant form was *Dreissensia polymorpha*, but none of the examples attained to a large size, 27 mm. being the length of the largest valve, but this is apparently owing to the crowded manner in which they lived. The next most abundant form was *Planorbis crista* (= *nautileus*), which occurred of all ages, and was well-developed, some examples measuring 3 mm. in diameter. *P. albus* also was by no means dwarfed, the largest specimen attaining a diameter of 5 mm.

¹ Jeffreys (J. G.) *British Conchology* (1862). Vol. I, p. 48.
 Standen (R.), *Naturalist*, 1887. pp. 159-160.
 Macgillivray (J.), *Zoologist*, 1852. Vol. x., p. 3420.

The examples of *Neritina fluviatilis* were small, but the coloration, though not brilliant, was well developed. *Limnaea pereger*, though common, was dwarfed, 12 mm. being the height of the largest example. *Bithynia tentaculata* and *B. leachii* were scarce and dwarfed. *Ancylus fluviatilis* was very common and of average size, whilst its ally, *Velletia lacustris*, was dwarfed.

The differences between the development of the various species no doubt arises from the relative abundance of food, and it is evident that these mollusca can exist without light.

If, as is probably the case, other water-mains which are still in use contain a like abundance of molluscan life, it must constitute a standing danger to the population using the water drawn from such sources.

Mons. A. Locard² has published a long list of species (so-called) of mollusca from the water-mains of Paris, and all the species that we have recorded are in his lists.

NEW ESSEX MARINE FISHES.

IN Dr. Laver's catalogue of the Fishes of Essex in the first volume of the *Victoria History*, several species are included which were not known locally when the *Mammals, Reptiles and Fishes of Essex* was published in 1898. It seems desirable to record these here for convenience of reference. We therefore make the following extracts from the *History* :

Family DISCOBOLI.

Lepadogaster bimaculatus, Penn. Double-Spotted Sucker.—Has been rarely recognised, but there is [? was] one specimen in the Brightlingsea Marine Station, caught in the mouth of the Colne.

Family BLENNIDÆ.

Blennius gattorigine, Bloch. Gattorugine.—Mr. E. A. Fitch records the capture of one specimen in the Blackwater, off Stangate, in August, 1898. (See *ESSEX NAT.* xi., p. 143).

Family GADIDÆ.

Gadus minutus, Linn. Power or Poor Cod.—Mr. E. A. Fitch says that this is not rare at times in the Thames Estuary.

² A. Locard "Malacologie des Conduites d'eau de la ville de Paris," *Mém. Acad. Sci. Lyon.* Sér. III., Tom. II. (1893), pp. 341-416.

Molva vulgaris, Flem. Ling.—Mr. Fitch writes that his informant, G. Gibson, has seen several Thames examples 9 to 12 inches long, during the winter and spring months, and one was obtained in the trawl below Southend Pier on April 1st, 1897. It measured one foot in length, and contained in its stomach a rockling half as big as itself.

Hippoglossus vulgaris, Flem. Holibut. — This was recorded from Fowlness by Mr. H. L. Matthams in *ESSEX NAT*, x., 292. Dr. Laver adds that another about five feet long was reported to have been captured about 30 years ago.

Family PLEURONECTIDÆ.

Hippoglossus limandoides, Bloch. Long Rough Dab.—Mr. Fitch says that specimens of this fish have been taken in the Blackwater in the spring.

Zeugopterus unimaculatus, Risso. Eckström's Topknot.—Occasionally taken, but very rare.

Z. punctatus, Bloch. Müller's or Common Topknot.—As an Essex fish, is very rare. Mr. Fitch says that one was caught in the Blackwater, September 6th, 1900. Another in the Crouch, November 6th, 1900. And as both these were considered by the fishermen to be young brill, it is probable that the species may be not uncommon, although seldom recognised.

Arnoglossus laterna, Walb. Scaldfish or Megrim.—Dr. Laver was informed by Mr. Fitch that one of these fish was caught in a trawl, near the Chapman Light, on April 21st, 1900. It measured five inches long.

Pleuronectes cynoglossus, Linn. Pole, Craig Fluke, or Long Flounder.—Very rare. Mr. Fitch writes that he has a specimen from the Blackwater.

The List of Essex Fishes will now stand as follows:—

Records in Dr. Laver's book <i>Marine Fishes</i> 85, less the large-headed cod, a variety of the common cod	..	..	..	84
Add the species recorded above	..	..	..	10
Fresh-water fishes, 28, less the sheat-fish and gold-fish, both introductions, and the azurine, a variety of the rudd	..	..	..	25

119

But as the Lampreys, three in number in Essex, are now generally removed from the Pisces to form the Class

Cyclostomata, we have 116 as the revised total, up to the present date, of true fishes occurring in the Essex streams and ponds, and the restricted marine area recognised by Dr. Laver. Doubtless many more will be added from the Thames Estuary and elsewhere when the much desired systematic explorations are undertaken, especially if a somewhat more elastic definition of the "Essex Marine Shallow-Water District" is adopted, following the custom of other county recorders. (See E. N. ii, 40 and xiii., 37; also Laver's *Fishes*, p. 13).

THE ESSEX FIELD CLUB: REPORTS OF MEETINGS.

THE 218th ORDINARY MEETING.

SATURDAY, DECEMBER 6TH, 1902.

The meeting was held in the Technical Institute, Stratford, at 6.30 as usual, Prof. R. Meldola, President, in the chair.

New Member.—Mr. George Miles was elected.

Cuttle-Fish Exhibited.—Mr. W. Cole showed a fine specimen of *Sepia officinalis* from the North Sea, presented by Mr. Goodchild. This specimen was very much larger than the one exhibited at the last meeting. The animal was seldom obtained immediately off the Essex Coast, and then generally in the young state.

Neolithic Implements from Chelmsford.—Mr. Henry Mothersole sent for exhibition two flint implements found by himself near Chelmsford. One was a hammer-stone, showing evident marks of use, with a curved ridge, very like the one figured in Evans' *Stone Implements*, p. 246. These specimens will be figured and described in a future part of the *E.N.*

Paper Read.—Mr. A. S. Kennard read extracts from a paper by himself and Mr. B. B. Woodward, F.L.S., F.G.S., on "The Non-Marine Mollusca of the River Lea Alluvium at Walthamstow." The paper included the molluscan results of the recent excavations in making the East London Company's new reservoirs. One of the most noteworthy results of the investigation was the discovery of *Planorbis stroemii*, a shell not hitherto reported from these islands either living or extinct. The paper was published in the last part of *E.N.*, *ante*, pp. 13-21.

At the same time, Mr. Kennard very kindly presented a full set of the shells to the Club's Museum.

A vote of thanks was cordially passed to the authors on the motion of the President, who congratulated them upon a remarkably good piece of work. The numerous papers which would probably be the result of the study of the excavations in the Lea Valley would be most interesting and valuable as contributions to local geology, archæology, and palæontology.

Demonstration of Tri-colour Photography.—Mr. Edward R. Turner then gave a practical DEMONSTRATION of the Lumière Company's process of

Tri-colour Photography and its application to natural history work, the making of lantern slides of insects, flowers, and micro-photographs, &c. Mr. Turner's exposition was illustrated by many beautiful examples of the process, shown by the lantern.

A very considerable discussion on methods and results ensued, carried on by the President, Mr. John Spiller, F.C.S., Mr. F. H. Varley, F.R.A.S., Mr. Briscoe, B.Sc., Mr. Crouch, the Lecturer, and others. But as these remarks pertained mainly to points of photographic practice, they are unsuitable for reporting here. The object of Mr. Turner's exposition was to show what a beautiful and practical method had been placed in the hands of the naturalist. We have also the Sanger-Shepherd process, the methods and results of which were so well shown at late meetings of the Club by the inventor and by the slides illustrating the lectures of Professors Poulton and Meldola.

Mr. Turner was most heartily thanked for his interesting and well presented demonstrations.

THE 219th ORDINARY MEETING.

SATURDAY, JANUARY 31ST, 1903.

This meeting was held as usual at the Technical Institute, Stratford, at 6.30 p.m., the President in the chair.

Photographs of Colchester Charters and Essex Churches.—Mr. J. Avery showed a set of the photographs (32 in number) made by Mr. J. C. Shenstone, F.L.S. (one of the *Vice-Presidents* of the Club) of the Charters of the Borough of Colchester, from Richard II. downwards, together with many other Charters and records of historical interest. The photographs were made for and presented to the New Town Hall, and were printed by the carbon process, but a very few copies (12) were struck off and acquired by residents of the town. Mr. Avery's copy is believed to be the only one outside the borough.

Mr. F. J. Brand exhibited an interesting album of photographs of Essex Churches.

Palæolithic Implements from Leyton.—The Secretary exhibited on behalf of Dr. Frank Corner, F.G.S., a set of over 30 Palæolithic Implements found in making excavations in the valley of the Fillibrook at Leyton, Essex. Some of them, from the gravel about 6 feet down, were much rolled and water worn; but at the 9 feet level sharper specimens occurred, and this level appeared to have been the "living floor" of the makers of these implements. Dr. Corner had presented the whole series to the Club's Museum.

Mr. W. Whitaker, F.R.S., made some remarks on the implements, which he considered to be very interesting, coming as they did from one locality. It was most desirable for finds of this kind to be kept together.

The President, in suggesting that Dr. Corner should be thanked for his donation, alluded to the excellent scientific work of Mr. Worthington Smith in collecting and studying the implements unearthed in particular spots. Care in this respect had enabled Mr. Smith to prove the existence of working-places or "Palæolithic Floors" on the margins of the old Thames and Lea.

The vote of thanks was cordially given.

Later Tertiary History of East Anglia.—The President said that Mr. W. F. Harmer, F.G.S., had sent for the library a reprint of his paper on "A Sketch of the Later Tertiary History [of East Anglia]," published in the

Proceedings of the Geologists' Association. The President and Mr. Whitaker pointed out the value of this paper (alluded in a note in the present part) as a summary of the present state of knowledge on the subject. Any student wishing to gain an insight into the geology and palæontology of the Crags of Essex and Suffolk could not do better than make this paper his guide. Thanks were voted to Mr. Harmer for his interesting communication.

Photographic Survey of Essex.—Mr. A. E. Briscoe, B. Sc., *Principal of the Technical Institute*, then read a paper entitled "Proposals for a Photographic and Pictorial Survey of Essex, in connection with the Essex Museum of Natural History." This paper was published in full in the last part of the *ESSEX NATURALIST*, *ante*, pp. 1-5.

A letter was read from Sir Benjamin Stone, *President of the National Photographic Record Association*, in which the writer gave some useful hints on the subject, and cordially approved of the scheme for Essex.

An interesting discussion was carried on by the President, Mr. G. Scamell (*the Secretary of the National Association*), Mr. W. Whitaker (*Chairman of the Surrey Survey*), Mr. Avery, Mr. W. Cole, Mr. F. J. Brand, and Mr. Briscoe.

The Secretary suggested that Mr. Briscoe's paper should be printed in the *ESSEX NATURALIST*, and that after a committee had carefully considered practical plans, a meeting should be called in the summer in some central place in Essex, when the proposal could be formally placed before the county.

A cordial vote of thanks was passed to Mr. Briscoe, the President remarking that they were much obliged to him for affording the Club an opportunity of making a practical movement towards realizing a very fascinating idea.

The Club's set of photographs showing the effects of the Essex Earthquake of April 22nd, 1884, was exhibited.

THE 220th ORDINARY MEETING.

SATURDAY, FEBRUARY 28TH, 1903.

This meeting was held at 6.30 p.m., in the Technical Institute, West Ham, Mr. Walter Crouch, F.Z.S., Vice-President, in the Chair.

The Chairman said that the members would much regret that serious illness prevented the President, Professor Meldola, from being present that evening.

New Members.—The Rev. E. C. Carter and Mr. Z. Moon, Chief Librarian, Public Libraries, Leyton.

Exhibitions.—Mr. F. W. Elliott exhibited and presented to the Museum some nests of the solitary wasp, *Eumenes coarctata*, from Bournemouth, together with hymenopterous parasites bred therefrom. He and Mr. W. Cole also exhibited portions of nests of species of *Vespa*, in illustration of Mr. Connold's lecture.

British Marten Presented.—The Curator exhibited a fine specimen of the British Marten (*Mustela martes*, L.) presented to the Museum by Mr. T. E. Harting, F.L.S. The animal was killed in Westdale, Cumberland, in October, 1887. It had been engraved by Mr. G. E. Lodge for a plate in the *Zoologist*, 1891. A cordial vote of thanks was passed to Mr. Harting for this valuable donation.

Diagrams of Cryptogamia.—The Curator called attention to 14 large coloured diagrams (framed), which formed part of a series of botanical subjects now being made to go round the gallery of the Museum, over the botanical cases

which would be fitted eventually. The diagrams were original coloured drawings made by Dr. M. C. Cooke specially for the Museum, and consequently they were of interest and educational value.

Nomination of Officers and Council.—In view of the Annual Meeting Nominations of Officers and New Members of Council were made. (See report of the Annual Meeting.)

Lecture on British Vespidae and their Vespiaries.—A lecture on this subject was delivered by Mr. Edward Connold, F.E.S., illustrated with over fifty lantern slides, photographed by Mr. Connold from actual specimens in his possession, illustrative of the British Social Wasps and their Architecture. The six species of British Vespidae were depicted as seen under natural conditions. The mechanism by which the sting is moved, and the wings linked together was explained. The construction of a Vespiary, from its earliest stage until disintegration takes place, was fully shown. And a unique set of charming views portrayed the actual digging out of a nest of *Vespa germanica*, which had contained about 45,000 inhabitants.

At the close of the lecture an interesting discussion on the habits of wasps was carried on by the Chairman, Mr. F. Enock, Mr. Elliott, Mr. F. H. Varley, Mr. W. Cole, and the Lecturer, and at the end Mr. Connold was cordially thanked for his very interesting and well illustrated lecture.

THE 23rd ANNUAL GENERAL MEETING.

SATURDAY, APRIL 4TH, 1903.

The 23rd Annual Meeting of the Club was held as usual at Stratford, Professor G. S. Boulger, F.L.S., Vice-President, in the Chair.¹

The minutes of the Annual Meeting, held on March 22nd, 1902, and printed in the *ESSEX NATURALIST*, Vol. xii., pp. 261-2, were read and confirmed.

The Chairman said that the members were sorry that Professor Meldola's continued illness prevented his presence amongst them, and the same regrettable cause would deprive them of a Presidential address that evening.

It was also announced that the Treasurer was unavoidably detained on the Continent. The usual financial statements from him and the passing of the balance-sheet was postponed until a later meeting.

The Secretary read the Annual Report of the Council for the year 1902. This was received and adopted, and it is printed in the present part of the *E.N.* pp. 88-91.

At the meeting on February 28th last, the following members retired from the Council by the Rules:—Rev. W. S. Lach-Szyrma, Right Hon. Lord Rayleigh, F.R.S., Mr. E. N. Buxton, J.P., and Mr. J. E. Harting, F.L.S. And there was one vacancy.

At the same meeting the following were duly proposed:—Rev. W. S. Lach-Szyrma, Right Hon. Lord Rayleigh, Mr. E. N. Buxton, Mr. J. E. Harting, and Mr. Robert Paulson.

As Officers for 1903 the following were nominated:—*President*—Mr. F. W. Rudler, F.G.S., Vice-President Anth. Inst. (late Curator of Museum of Practical Geology); *Treasurer*—Mr. David Howard, J.P., F.C.S.; *Hon. Secretaries*—

¹ It had been necessary to postpone this meeting from the date originally fixed (viz., March 28th) in consequence of the Students' Conversazione at the Institute taking place on that evening.

Mr. W. Cole, F.L.S., F.E.S., and Mr. B. G. Cole ; Librarians—vacant ; Auditors—Mr. Walter Crouch, F.Z.S., and Mr. J. D. Cooper.

No other members having been proposed for any office, the above gentlemen stood elected as Members of the Council and Officers for the year 1903, and were so declared by the Chairman.

Mr. John Spiller proposed that a cordial vote of thanks should be given to their retiring President, Professor Meldola. They all most deeply sympathised with him in his illness, and most sincerely hoped that it would soon pass away. Mr. Meldola's services to the Club were fully known to most of those present ; in his last annual address he had admirably summed up its history, and they all regretted that no like inspiring discourse had been possible from him that evening.

Mr. T. V. Holmes most cordially seconded the vote of thanks and message of sympathy to the late President.

With a few appreciative words from the President, the motion was agreed to by acclamation.

On the motion of Mr. Hugh McLachlan, a vote of thanks was passed to the Officers and to the Auditors.

Mr. Walter Crouch briefly responded, and the meeting ended.

THE 221st ORDINARY MEETING.

SATURDAY, APRIL 4TH, 1903.

After the business of the Annual Meeting, an Ordinary Meeting (the 221st) was held, Mr. F. W. Rudler, F.G.S., President, in the Chair.

New Members.—At the Annual Meeting Mr. Walter Bevins, and Mr. F. W. Rudler (one of the Honorary Members of the Club) had been elected Ordinary Members, and the fact is entered here for confirmation.

President.—Mr. Rudler thanked the members for placing him in the honourable position of President of the Club. He alluded to the high reputation in which the Club was held, inasmuch as it was carrying on excellent local work ; it *might be* looked upon as a model local natural history society. Mr. Rudler also referred to the valuable work of the retiring President, Professor Meldola, in relation to the Club, and hoped to receive the aid and encouragement of the Council and Officers in carrying on the work during his term of office.

Series of Flint Implements from the Thames Valley Gravels.—Mr. A. S. Kennard exhibited a fine series of Flint Implements found in the Thames Valley, and said that his object was to bring together examples of the work of man from the age of the "Rock Shelters" back to the age of the Eoliths. Mr. Kennard's remarks will be embodied in a short note, on "The relative age of the Thames Valley Stone Implements." He also exhibited a flint arrow-head from Forest Gate, which will be figured and described in the next part of the *ESSEX NATURALIST*.

Museum Microscope.—Mr. Cole exhibited one of the Museum Microscopes made by Messrs. W. Watson and Sons, which were intended for the exhibition of minute organisms and biological and petrological specimens in the Museum. (See "Note" in a future part.)

Stone Implements from the Laterite Deposits of India.—A set of specimens from these deposits, presented to the Museum by Mr. W. Seton-Karr, was exhibited.

Victoria History of Essex.—It was announced that Dr. H. C. Sorby, F.R.S., had kindly subscribed on behalf of the Club for a set of this important work for the Library. The first volume, recently published, was on the table.

Eoliths from Grays.—Mr. A. S. Kennard presented a set of specimens of supposed Eolithic "worked" stones from near Grays, Essex, for the Museum.

Cordial votes of thanks were passed to Mr. Seton-Karr, to Dr. Sorby, and to Mr. Kennard for these donations.

Papers Read.—Mr. A. S. Kennard read two short papers by himself and Mr. B. B. Woodward, F.G.S., F.L.S., one being entitled "Notes on Sections in the Lea Valley at Canning Town," and the other "Note on the occurrence of Fresh-water Mollusca in a Water-Main at Poplar." (These papers are printed in the present part of the E.N.)

Thanks were voted to the authors of these papers on the proposal of the President, who alluded to the value of such notes, which were typical of the kind of work which a local scientific society should encourage.

Lecture.—Mr. D. J. Scourfield, F.R.M.S., gave a lecture on the "Locomotion of Microscopic Aquatic Organisms," which was illustrated by about 40 photographic lantern slides, many of them being taken from original drawings. The Lecturer commenced with the *amœba* and its allies, the lowest known forms, in which the locomotive organs were not permanent, but mere out-pushings of the protoplasm, which were again absorbed into the body mass. From these he passed to the Infusoria, which moved by means of whip-like threads (*flagella*) or rows of shorter threads (*cilia*), dealing afterwards with the rotifers, with discs fringed with *cilia*, and the higher forms bearing spines simulating limbs, and so on to the minute crustaceans, in many of which the feelers are modified to serve as organs of locomotion, while the chief function of the legs is to bear the gills, and thus carry on the process of respiration.

A short discussion was carried on by Professor Boulger and the Lecturer, who was cordially thanked on the proposal of the President. It is probable that the substance of Mr. Scourfield's lecture will be given in the form of a paper in the *ESSEX NATURALIST*.

ANNUAL REPORT OF THE COUNCIL FOR THE YEAR ENDED DECEMBER 31st, 1902.

[Read and adopted at the 23rd Annual Meeting on April 4th, 1903.]

FINANCIAL.—[Owing to Mr. Howard's absence from England the statement of account was not read at the meeting. It will be published later.]

MEETINGS.—Twelve were held in the year, one (the "Fungus Foray") being a two-day meeting. The papers, "notes" and exhibits have fully equalled in interest those of former years. All the papers read have been or will be published in the *ESSEX NATURALIST*. The most important meeting of the year was that held on June 14th in Hainault Forest, in support of Mr. Buxton's scheme of re-forestation. This was marred by the wet weather, but was nevertheless a remarkable assembly, and we may hope did something in aid of the realisation of a grand idea. On June 17th Lord and Lady Rayleigh very kindly received the Club at Terling Place, and Lord Rayleigh delivered an

interesting address on "Colour in Nature." The Council was also much indebted to Mr. Charles H. Read, F.S.A., Keeper of the Department of British and Mediæval Antiquities at the British Museum, for the address on "Local Archæological Investigation," which he gave at the meeting in January. At the following meeting, on February 22nd, Professor E. B. Poulton, F.R.S., the Hope Professor of Zoology, University of Oxford, delighted the audience with a lecture (most beautifully illustrated by photographs in colour) on "Protective Resemblance, Warning Colours, and Mimicry," and on this occasion the Club had the benefit of some remarks on "Mimicry" from Professor Meldola. At the March meeting Mr. Frank P. Smith spoke of "Spiders and their Ways," preparatory to a series of papers he is writing for our journal on the "Spiders of Epping Forest." The "Fungus Foray" on October 17th and 18th, was like so many outdoor meetings in 1902, somewhat shorn of the usual goodly company by more than doubtful weather, but scientifically it was not a whit behind its fore-runners, inasmuch as no less than 134 species were gathered and determined by Dr. Cooke and Mr. Massee, of which 18 were new to the Forest Flora. On this occasion also the Club had the assistance of Mr. Arthur Lister, F.R.S. At the meeting on December 6th Mr. Edward R. Turner gave an excellent demonstration of the Lumière process of Tri-Colour Photography and its application to Natural History work.

At some of the meetings the kind assistance of the following gentlemen, acting as "Conductors," was highly appreciated: Mr. J. Chalkley Gould, Mr. Primrose McConnell, Mr. E. N. Buxton, Mr. W. H. Dalton, Mr. T. V. Holmes, Mr. J. E. Greenhill, Mr. Miller Christy, Rev. C. Boutflower, and Mr. Frank Smith.

The Council have pleasure in again recording the best thanks of the Club to the Technical Instruction Committee of the West Ham Corporation, and to the Principal, Mr. Briscoe, for the use of the meeting-room and for other facilities.

THE ESSEX NATURALIST.—With the view of securing more regularity in the publication of our journal the Council have accepted the estimate of Messrs. Benham and Co., of Colchester, for the printing. It is confidently anticipated that with the new year, the parts will appear quarterly, viz., on or about the 20th of April, July, October, and January, in each year. The price of the parts to non-members will in future be uniformly 5s., so that the best way to obtain the *ESSEX NATURALIST* will be to join the Club. Two parts comprising 216 pages with several plates, and Title and Index to Vol. XI., were published in the year. The Council asks for the aid of the members and friends of the Club to the Editor so that he may be enabled to produce the journal as a regular quarterly publication. It is manifest that he is entirely in the hands of contributors so far as regards original papers; a supply of Notes and Short Papers likely to interest zoologists, botanists, geologists, and students of pre-historic archæology, etc., in the Eastern Counties, and the East and North of London, would be of the greatest value in connection with the journal and would markedly tend to increase the interest of members in the work of the Club.

ESSEX MUSEUM OF NATURAL HISTORY.—The central museum has benefited by several donations within the year, the most remarkable having been the gift by our member, Mr. T. Horace Brown, F.R.S., of the whole of his extensive and valuable collection of fossils and rock specimens, together with a small type collection of mollusca. This donation was made by Mr. Brown and gratefully accepted by the Council to aid in the building up of the educational

collections which we hope to have in the museum in addition to the local series. The Council have pleasure in acknowledging specimens of small collections from Mr. J. E. Harting, Mr. H. Seton-Karr, Mr. Johnson, Mr. Kennard, Mr. Goodchild, Mr. F. C. J. Spurrell, Dr. A. Wilson, Messrs. W. and B. G. Cole, and others. Mrs. Sewell presented the herbarium of her late husband, our member, Mr. A. S. Sewell, to the Club's museum. Very considerable alterations and additions have been made, but it will be better to defer a description of these until the Curator can report a closer realization of the "idea" of the museum. It is anticipated that most of the public collections will be at least temporarily arranged by the close of 1903. The Curator takes this opportunity of again emphasising the really urgent necessity of systematic collecting, especially of marine and coast forms of life. The assistance he receives from members and others is too sporadic. It is much to be wished that some of our younger members would take up definite groups, and endeavour to collect for the museum good and authentic Essex specimens in such groups. This would confer great benefits both upon themselves and upon the museum, and the assistance they could claim from head-quarters in the determination of and information about specimens in their own collections would compensate them for the slight additional trouble. But above all we need explorations carried out by the Club itself; until we are able to do this our museum will not progress at the rate all well-wishers desire. And at the present time one great need of the museum is extensive cabinet accommodation; we have at present many thousand specimens awaiting systematic arrangement and cabinet space, and the need will rapidly grow in extent and exigence. How to obtain these costly cabinets is a problem that must be faced in the near future. The most notable presents to the library were the *Handbook of British Birds* from Mr. Harting, Gilbert's *De Magnete* from Professor Meldola, and the supplemental volume of the same from Professor Silvanus Thompson. From the executors of our late member Mr. Augustus Cunnington, we have received the posthumous privately printed catalogue of his Essex library.

EPHING FOREST MUSEUM.—This institution has been a source of considerable anxiety to the Council and the Curator. The re-fitting with new cases, and the restoration of the old ones, is now completed, but the heavy cost of this work has exhausted the funds in hand. It is imperative, in view of the Club's agreement with the Corporation, that the re-arrangement of the Museum should be proceeded with at once. The Club's Epping Forest Museum Committee have this matter in hand, but it is manifest that further subscriptions are necessary. About £150 would finish the collections in hand, and furnish several cases of mammals and birds, mounted with natural surroundings, a kind of exhibition which appears to be necessary for the popular appreciation of the Museum. This is all that need be said at present; it is probable that a public meeting will be called in the early summer, in order to place the facts of the case and the needs of the institution clearly before the members and the inhabitants of the Forest districts.

CONFERENCE MEETING.—The joint meeting of the three "East Anglian" Societies, proposed at Ipswich, fell through mainly by reason of the heavy charge for a steamer. After much correspondence, our Secretary is reluctantly compelled to admit that he sees little hope at present of a combined action in the way of publication. Efforts should be concentrated in endeavours to establish an annual or biennial meeting of the Societies for mutual encouragement and discussion. In connection with the Conference of Corresponding Societies at the

Belfast meeting of the British Association, the Council have to thank our Hon. Member, Mr. W. Whitaker, F.R.S., for acting as the Club's Delegate.

RE-AFFORESTATION OF HAINHAULT.—The Council can hardly permit the report of the year to pass without recording the warmest thanks of the Club to the Vice-President, Mr. E. N. Buxton, for his persevering efforts to reclaim a large part of Old Hainhault Forest. It is a matter in which the Club can only act by way of exhortation and example, but the Council had much pleasure in organising the meeting in the Forest on June 14th, to which reference has already been made. The best wishes of all naturalists and lovers of open spaces will be with Mr. Buxton in his truly noble work.

PROFESSOR MELDOLA.—The Council wish to express their warm thanks to Prof. Meldola, F.R.S., for his work as President during the past two years. During the whole life of the Club our President has had its welfare close to his heart, and a very valuable record of our work was the subject of his Presidential Address last year. In the Club's interests he can only regret that pressure of Professor Meldola's engagements in the cause of Scientific Education, and particularly of ill-health during the period immediately preceding the Annual Meeting, has precluded the preparation of a valedictory address. But we still retain his services as a Permanent Vice-President, and may look forward to his advice in the future as in the past.

PRESIDENCY.—The Council have great pleasure in recommending that Mr. F. W. Rudler, F.G.S., V.P. Ant. Inst., and late Curator of the Museum of Practical Geology, be elected President. Mr. Rudler has for many years been an Honorary Member of the Club, and is now qualifying as an Ordinary Member, so as to be eligible for election as President.

NOTES—ORIGINAL AND SELECTED.

ZOOLOGY.

BIRDS.

The Influence of the Nature of the Soil on Poultry.—

In the *Live Stock Journal Almanac* for 1903 there is an article by Mr. Edward Brown, F.L.S., entitled "Breeds of Poultry for Farmers" in which the writer states:—

"Some years ago I was consulted by a farmer in Essex, whose idea was to develop table poultry on similar lines to those met with south of the Thames. He lives in a very heavy clay-soil district. I pointed out to him that it was altogether unsuitable for the best qualities of table poultry, and that his wiser plan would be to go in for egg-production. Personally I was not then as fully convinced of the causes for this advice as is now the case, and was unable to give him as clearly as might have been desired the reasons for my objection. However, he went on, and found that what had been stated was absolutely true, so that he was compelled to give up the attempt and turn his attention to the production of eggs. In experience it is found that chickens take much longer to mature upon heavy land, and thus the cost of production is much greater, whilst the best quality is not realised. To summarise the results of inquiries which

have been made to a considerable extent both at home and abroad, the conclusions arrived at are :—First, that upon heavy soil egg production should be the main object ; second, that upon medium soils, whilst better table poultry can undoubtedly be produced, still eggs should be kept largely in view ; third, that it is upon the more porous and kindlier soils that we may fairly expect to secure the finest qualities of table poultry."

Mr. Brown adds, with regard to the influence of the soil on the colour of the legs of poultry :—

"A friend who lived for several years upon the lowlands in East Essex, where the soil is very heavy, was a breeder of a yellow legged and fleshed variety, and his birds were remarkable for the brightness of their legs. He removed to another county where the soil was lighter, and the result was that the birds became distinctly paler in colour of leg."

Mr. Brown wishes that "a geological map could be prepared for every district, showing the class of poultry which may be reared within that area."

MOLLUSCA.

Marine Mollusca at Walton-on-Naze. — *Petricola pholadiformis*, Lam., occurs both alive and dead in the London Clay, between tide-marks, to the South of Walton-on-Naze. Dead shells were collected last summer by Mr. C. W. Vincent. Judging from the size of those I obtained in May this year, the species must have been established at Walton for several years. *Pholas candida*, its usual companion, also occurs plentifully in the same locality. [For other Essex localities for *Petricola* see **Essex Naturalist** xii., 168.] *Acera bullata*, Müll. (recorded for Walton in *British Conchology*, IV., 431), was abundant in the "back-water" near the Old Mill at Whitsuntide this year.¹—J. E. COOPER, Highgate, 18th June, 1903. [Mr. Cooper has kindly presented specimens of Walton *Petricola* and *Acera* to the Club's Museum. ED.]

INSECTS.

A Raid by Ants.—On the 30th June, 1903, whilst walking through a copse about three-quarters of a mile to the W.N.W. of Newick Station (near Lewes, Sussex), my attention was attracted to a column of ants, about eighteen inches wide, which extended across the path. The ants were crossing in both directions, but many of those going in a westerly direction were dragging caterpillars, the size of which varied from $\frac{1}{4}$ inch

¹ *Acera bullata* was recorded for the Blackwater by Mr. Walter Crouch, *F.N.* ii., 248, and Dr. Sorby says (*Victoria History* i., 83), that it must be common "in the upper part of the Stour, and I think I have collected it in the Colne."

to 1 inch in length. Mr. Cole has since identified the caterpillars as those of the "Winter Morth" (*Cheimatobia brumata*) and the ants as *Formica rufa*—the Wood-ant. The ants were very pugnacious, and those with burdens absolutely refused to give up their prize, even when their lives were in danger. The "looper" caterpillars were obtained from an oak tree about seven yards east of the path, and the column of ants was clearly defined, and much narrower in the undergrowth. The ants were scaling the tree in thousands, and had evidently a preference for one particular oak, though two others, a few yards distant, were attacked, but not in such great force. On the other side of the path the column stretched out to an ant-hill, and the total distance from the nest to the oak tree was 15 yards. An ant seized a caterpillar by a loose fold of skin under the body, and putting its legs astride it dragged its burden along in the same manner as a boy "rides" a toy horse. In cases where the caterpillar was very large, two ants set to work, one at each end of the "looper's" body. The scene of the "raid" was visited on the three following days, and the tiny robbers were found hard at work on each occasion.—H. WHITEHEAD, *Essex Museum of Natural History*.

BOTANY.

Variation in *Adoxa*.—The common form of the inflorescence of the Moscatel (*Adoxa moschatellina*) consists of five flowers forming a globose head. The peculiarity about the plant is that the flowers have two forms of symmetry, viz., the tetramerous and the pentamerous types, both of which occur on the same plant. In the normal inflorescence the terminal flower is tetramerous and the four lateral flowers are pentamerous.

Some material was collected during the Spring of 1902, with a view to studying the variation of this plant. Inflorescences were collected at Chiselhurst, Kent; Caterham, Surrey; and at Theydon Garnon, Essex; and it was found that considerable variation occurs both in the number of flowers and also in the number of the parts of the perianth. Out of 1,071 inflorescences, only 934, or 87·2 per cent. possessed the normal number of flowers, viz., five. The number of flowers per inflorescence ranged from three to ten.

The number of divisions of the corolla varied from three to

eight. In the normal inflorescence the 4-partite and 5-partite are in the ratio of 1 to 4, or 20 to 80, but the ratio of the observed percentages was as 33·1 to 65·3. The variation from the normal type, therefore, favours the tetramerous more than the pentamerous forms. During the examination of the material, 51 types of variation were noted. A detailed account of the variation of the plant was published in *Biometrika*, Vol. ii., Part i., Nov. 1902, pp. 108-13.—H. WHITEHEAD, *Essex Museum of Natural History*, June, 1903.

Vicia lutea near Witham.—I found on June 6th, 1903, a plant of *Vicia lutea* growing on the railway embankment near Witham—quite close to the locality from which, some time ago, Mr. Turner recorded *Euphorbia esula*, and where that plant is still abundant. I think that *V. lutea* has only once previously been recorded for the county, and that by Mr. E. A. Fitch, from St. Osyth (in *Essex Naturalist* vi., 116). It is difficult to see how the plant can have got into such a strange and unnatural habitat.—F. J. CHITTENDEN, County Technical Laboratories, Chelmsford.

“The Tinctorial Properties of our British Dye Plants.”—Under this title Dr. C. B. Plowright has an interesting and exhaustive paper in the *Trans. Norfolk and Norwich Naturalists' Society*, Vol. vii., pp. 386—394, which should be read in connection with the list of vegetable colouring matters used in the Scotch Highlands communicated by the Duchess of Sutherland (see *E.N.* Vol. xii., p. 45). Dr. Plowright examined about 70 plants, using as mordants only such simple substances as alum, ammonia, lime, potash, and green vitrol, which are those our ancestors may have employed. The general outcome of the experiments was that all colours which are obtainable from British dye-plants are of a sombre hue. The yellows predominate, and one or two (such as *Reseda luteola* and *Genista tinctoria*) were so good that they continued in use until the last half century. No bright permanent red could be obtained. The blue of woad (*Isatis tinctoria*) is of great beauty, but is a hue exceedingly difficult to extract. (See Corder, *Trans. N. and N. Nat. Soc.*, v., p. 144). Dr. Plowright says “Although a colour of pre-historic origin, yet it is one which to-day can only be obtained by the most careful management. In point of fact, the discovery that *Isatis* was

capable of dyeing wool blue, was as great a marvel in its way as the discovery of the art of producing fire." The most useful colours, the browns and blacks (tannin derivatives) are obtainable from various barks and roots, oak, alder, walnut, water-lily, tormentil, &c., while some of the lichens yield browns of great beauty. These colours are those still made use of in Scotland.

ANTHROPOLOGY.

A Neolithic Stone - Hammer from Braintree, Essex. — When the Rev. J. W. Kenworthy read his



FIG. I.—A STONE HAMMER-HEAD,
Probably of the Bronze Age, two-thirds actual size. Braintree.

paper on the Braintree Lake - Dwelling he was under the impression that a flint Arrow - head from the site was in the possession of Mrs. Sydney Courtauld. Upon enquiry however, Mrs. Courtauld very kindly told me

that the implement belonging to her was a stone Hammer-head, and although it was found in the neighbourhood she was not certain that it came from the Skitts Hill pits. As I was so lucky as to be able to borrow the hammer-head in order to photograph it, I am able to give the accompanying illustration (Fig. 1.) The length is three inches and the largest diameter two inches, while the perforation measures three-quarters of an inch across. A transverse section at any point would practically yield a circle. The material is red crystalline quartzite, characteristic of the Thames Basin.—WILFRED MARK WEBB, F.L.S., Hanwell.

MISCELLANEA.

Personal.—His Majesty has honoured Mr. F. W. Rudler by conferring upon him the decoration of Companion of the Imperial Service Order "For Faithful Service." The I.S.O. was created at the Coronation to mark the Sovereign's appreciation of long and meritorious work on the part of members of the Imperial Civil Service. All members of the Club will rejoice that our President's valuable services to the State and to Science, as Curator of the Museum of Practical Geology, and in many other ways, should have received recognition by the King.

We are also pleased to note that Mr. Worthington Smith has received a Civil List Pension of £50 for his services to Botany and Archæology; and that Dr. M. C. Cooke has been awarded the Gold Medal of the Linnean Society. Both these gentlemen have long been highly esteemed Honorary Members of the Club.

Influence of Environment.—The *Irish Naturalist* is responsible for the following, concerning a "Multinucleate Syncytium" well-known and valued by our members:—

"Professor Poulton, in opening the discussion on natural selection and mimicry in Section D (Brit. Association Meeting, Belfast), gave an excellent practical illustration of the rapidity with which response of the organism to its environment may take place. The learned speaker had not been a week amid Hibernian surroundings when, in discussing the relative numbers of mimickers and mimicked in a particular case, he stated that 'only one out of every thousand ants was a spider.'"

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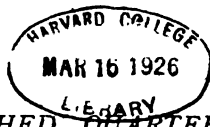
The Proposed Photographic and Pictorial Survey of Essex.

IN connection with this subject, Mr. A. E. BRISCOE, B.Sc., the author of the paper in the last part of the *ESSEX NATURALIST*, has addressed a letter to the newspapers, appealing to photographers, amateur and professional, who may have taken views of the recent floods in Essex, to furnish prints for the proposed collection in the Essex Museum. Mr. Briscoe says: "As it is of importance that these prints should be permanent, I should prefer made by either the platinotype or carbon processes. If prints by these processes cannot be supplied, well-washed bromide prints will be acceptable as substitutes. On the back of the prints should be written, in pencil, the date on which each negative was taken, the name and address of the photographer, and the exact locality of the scenes photographed. Any details that would be of interest should be sent on a separate sheet of paper. All the prints should be sent *unmounted*, so that a uniform system may be adopted for their preservation in portfolios." Prints in response to this appeal should be sent to MR. A. E. BRISCOE, *Municipal Technical Institute, West Ham, Essex.*

We hope that all having the opportunity will respond to Mr. Briscoe's request, and pending the formal inauguration of the Survey, that members and others will commence to collect photographs of interest, in accordance with the plan laid down in the "Proposals," so that a good start may be made this year.

We shall be happy to send a copy of Mr. Briscoe's paper to anyone interested and willing to help.

The meeting for the establishment of the "Survey" will, it is hoped, be held in the autumn, and due notice will be sent to all furnishing names and addresses for that purpose.—EDITOR.



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EDITED BY
WILLIAM COLE, F.L.S., F.E.S.,
Honorary Secretary and Curator.

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THE PALAEOLITHIC PERIOD IN THE THAMES BASIN.

By J. P. JOHNSON.

THE earliest evidence of pre-historic man's presence in the Thames Basin is afforded by an ancient deposit of gravel which occurs in patches on the Chalk Plateau known as the North Downs. The Plateau Gravel indeed is the oldest deposit that has yielded relics of the primæval savage. These consist of pieces of flint, the edges of which in most cases have been notched through use, though in many they have been chipped into more or less regular curves suitable for scraping, which is the commonest and no doubt one of the first uses to which a piece of flint was put by primitive man. These rude implements from the Plateau Gravel belong to the earliest, or Eolithic, period of the Stone Age.

After the deposition of the Plateau Gravel a great interval of time elapsed during which no fluvial beds were laid down in the area under consideration, so that when the next series of deposits—the valley-drifts—began to be formed, man had reached a much higher state of culture than that of the Eolithic period.

The valley drifts occur on the sides of the valleys where they have been left by the rivers at former epochs in their excavating career. They may be grouped into a high and low-level series, and consist chiefly of gravel, though the latter contain thick masses of brickearth or loam in places, especially in the main valley below London. The implements found in these deposits are termed Palaeolithic and differ very materially from those from the Plateau Gravel; indeed they mark a complete revolution in the art of making flint implements.

The scraping and allied tools, which still make up the bulk of the implements, are now all fashioned out of artificially produced flakes. Man had no longer any need to search for suitably shaped splinters, as he had now learnt to make them for himself. The method employed was to first obtain a flat surface by breaking off the end of a nodule and then driving off slices at right-angles to it by sharp blows with another stone. Some of these flake tools can now be assigned to definite purposes but the uses to which the majority were put are quite inexplicable. Fig. 1 shows a scraper of average workmanship.

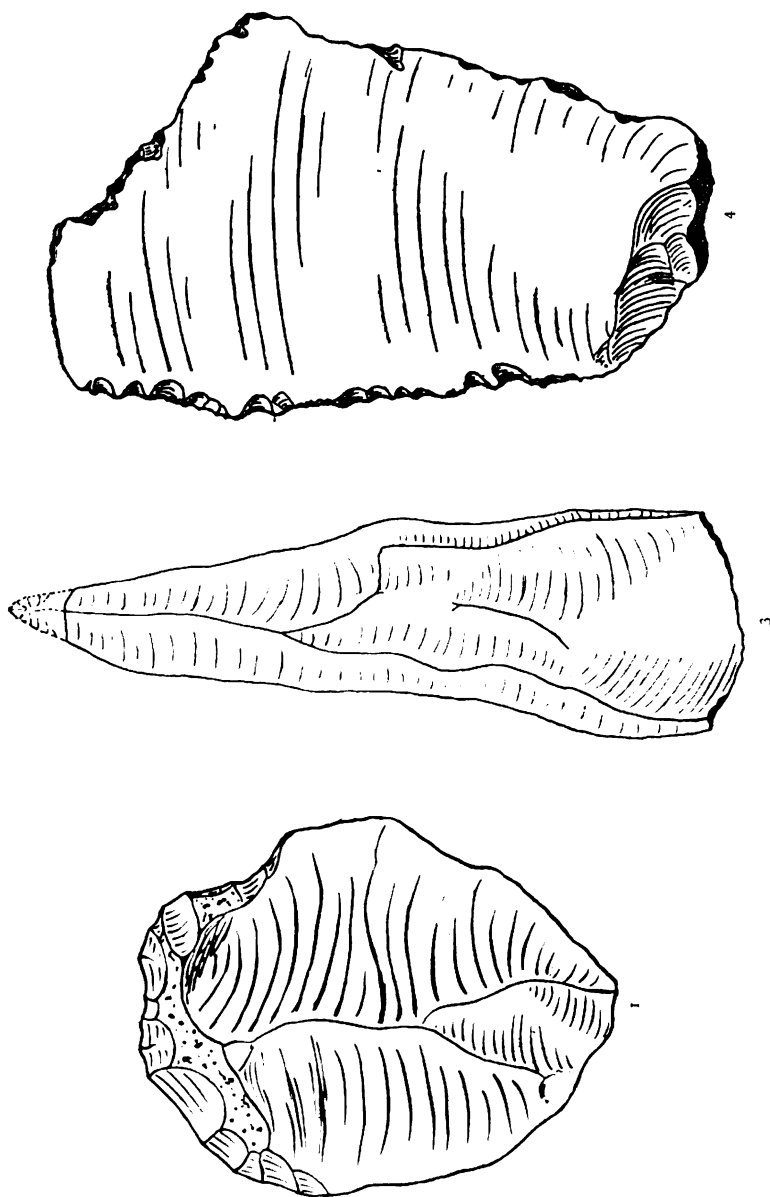


FIG. 1.—FLINT "SCRAPER" from Swanscombe; FIG. 3.—SPEAR-HEAD from Crayford; FIG. 4.—FLINT "SAW" from Ilford, Essex. All actual size.
 Drawn by J. P.

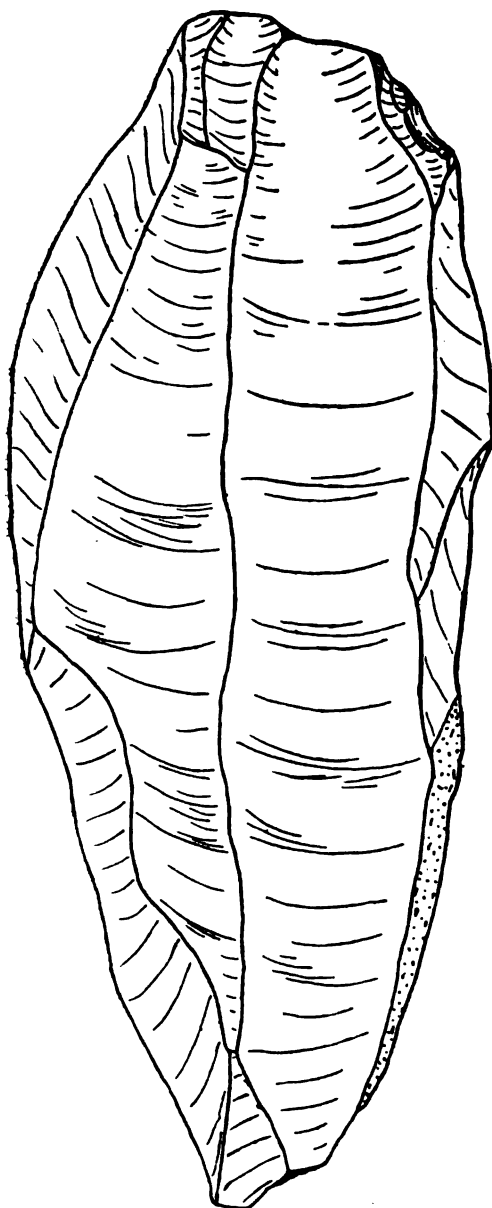


FIG. 2.—FLINT-KNIFE FROM CRAYFORD.
Drawn by J. P. Johnson. Actual size.

During the high-level epoch man does not seem to have been able to control the shape of the flakes, as they are nearly always large and somewhat clumsily produced, but by the time the low-level drifts were deposited he seems to have acquired great dexterity in the manipulation of flint, for the flakes are now usually small and neat, while others of designed shape, as for instance the long narrow flakes with a triangular section, such as require great skill in their production, are common. A good example of a designedly-shaped flake is that shown in Fig. 2. There can be no doubt that this was meant to be used as a knife, the broad end probably being bound round with vegetable fibre or animal sinew, after the style of the Australian knife figured by Sir John Evans,¹ and as such one cannot but admire its effectiveness. Even more eloquent of the ability of the later Palaeolithic people is the testimony of the spear-heads, one of which is represented by Fig. 3, for their shape is clearly the result of the skilful execution of a previously thought-out pattern. A fine example in the Natural History Department of the British Museum, in which the point has been artistically finished by small secondary chipping, bears a close resemblance to the obsidian spear-heads used by the natives of the Admiralty Islands.

A rare instrument of this period is the saw. Fig 4 shews a specimen from the low level drift at Ilford. It is a flake of slate-black flint, which has been serrated carefully along the edge. I found this, together with other flakes, *in situ*, in a bed of gravel, which yielded bones of rhinoceros and shells of land and fresh-water molluscs.²

Still more characteristic of the Palaeolithic period are the peculiar tongue-shaped implements. Eolithic man confined his work to the edges of the pieces of flint, but the tongue-shaped implements of Palaeolithic man are skilfully chipped all over, sometimes into delicate tapering points, and sometimes into thin flat blades. What these implements were used for is still a mystery, in spite of the attention that has been paid to them. Probably the majority were used as javelin or axe-heads, but our knowledge, meagre though it be, of the uses to which the

¹ Sir John Evans, *Ancient Stone Implements . . . of Great Britain*. London: 1872 and 1897.

² J. P. Johnson, "Palaeolithic Implements from the low-level drift of the Thames Valley."—*ESSEX NATURALIST*, vol. xii. (1901).

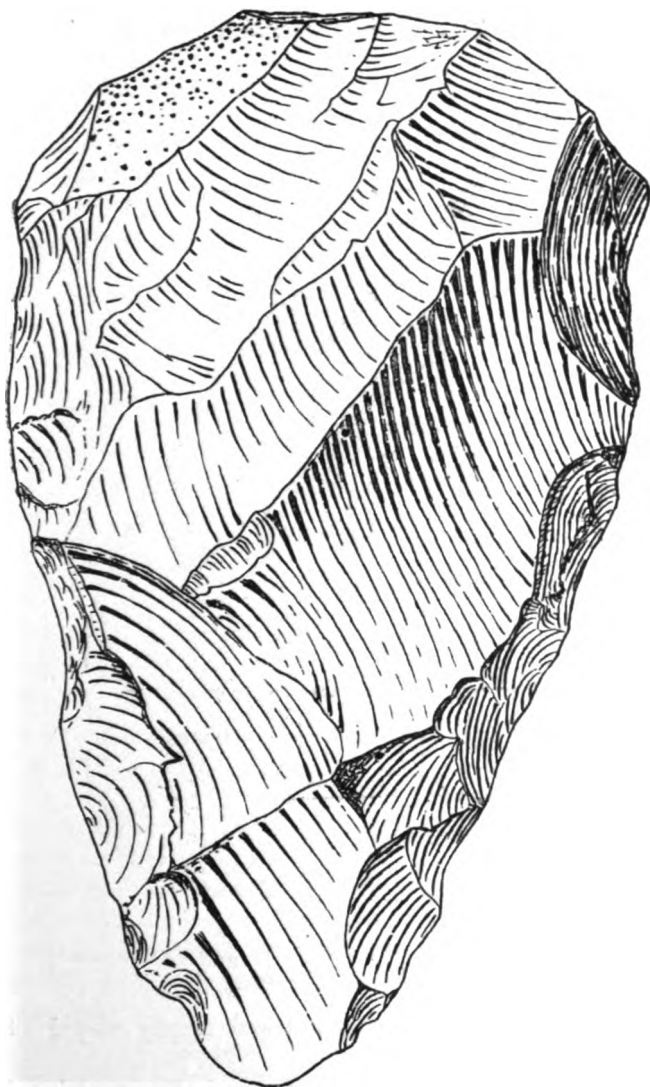


FIG. 5.—TONGUE-SHAPED IMPLEMENT, from Swanscombe, Kent.
Drawn by J. P. Johnson. Actual size.

Tasmanian aborigines put their implements³ warns us that such is not necessarily the case. Moreover, some of the highest authorities, notably Worthington Smith⁴ are of opinion that

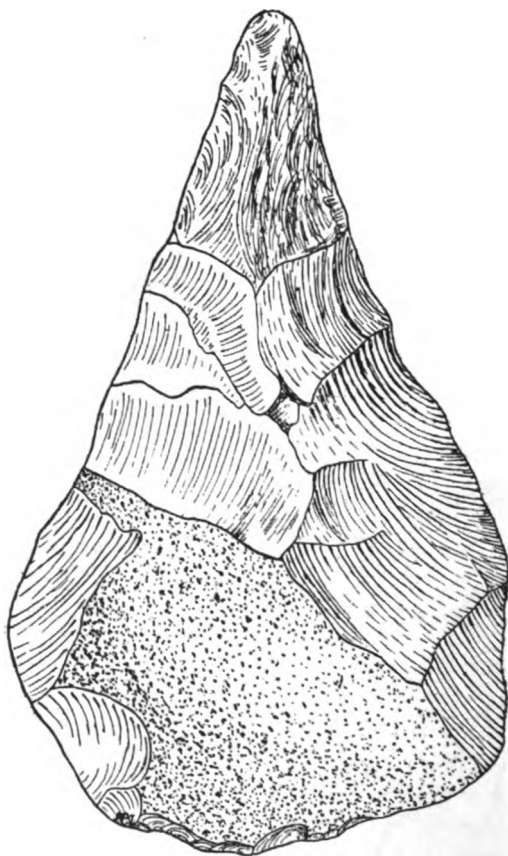


FIG. 6.—TONGUE-SHAPED IMPLEMENT from Swanscombe.
Drawn by J. P. Johnson. Actual size.

they were not hafted in any way, but were merely grasped in the hand.

A characteristic example is that shewn in Fig. 5. I imagine it to have been bound round, at the upper end, by a withe, and

³ See E. B. Taylor "On the Tasmanians as representatives of Palaeolithic Man." *Journ. Anthropol. Institute*, vol. xxiii. 1894.

⁴ Worthington G. Smith, *Man the Primæval Savage*. London, 1894.

used as an axe. This method of hafting is employed among certain existing savages.

Fig. 6 represents an exceptionally finely-pointed specimen. It may either have been used as a javelin-head, or else as an axe-head, in which case the point would have been wedged into a hole in the piece of wood forming the handle.

Fig. 7 shews a beautiful implement of rare workmanship and unusual form.

Another characteristic, though comparatively rare, type of axe-head is discoidal in shape, the oval periphery presenting an



FIG. 7.—TONGUED-SHAPED IMPLEMENT from Swanscombe.

Drawn by J. P. Johnson. Natural size.

acute edge. Semi-circular forms also occur. Allen Brown describes one from the low-level valley drift as "a very neatly made axe-head much more advanced in form as well as in workmanship than any instrument of that kind from the older drift of the higher levels which has come under my notice. The blade is skilfully chipped all over and the front is worked into a sharp cutting edge."

Even the actual land surfaces on which the Palaeolithic people manufactured their implements have been preserved here and there, buried under varying thickness of drift. So well defined are these old surfaces that in some instances the cracks

⁵ J. Allen Brown, "Working Sites and Inhabited Land-Surfaces of the Palaeolithic Period," *Trans. Middlesex Nat. Hist. Soc.* (1889).

which were produced in them by the sun's rays, in Palaeolithic times, have been preserved, having been filled up and covered with loam. There are sometimes strewn with the flakes resulting from the manufacture of implements.

On the accompanying sketch map of the Thames Basin, I have shewn the chief localities at which Palaeolithic implements have been found. Those places at which the actual working sites of Palaeolithic man have been discovered are indicated by dots, while those which have yielded the characteristic tongue shaped weapons are indicated by small circles.

The most westerly locality with which I am acquainted is Wolvercote,⁶ near Oxford, where Bell obtained one or two tongue-shaped implements, together with remains of urus and elephant. More recently the same gentleman has made a large discovery in this district of which, however, I have no details to hand.

Proceeding along the main valley eastwards, the next locality is Wallingford from which Sir John Evans (*op. cit.*) has recorded several of the characteristic implements.

An excellent summary of the discoveries in the Reading district has been made by Shrubsole.⁷ On the north bank, in a pit near Caversham, at 114 feet above the present level of the river, he has obtained a large number of the tongue-shaped weapons from a bed of gravel resting on chalk. He concludes that they could not have been made far from the spot upon which they were found. He also mentions the finding of a horse's tooth in the same deposit. At Shiplake, about three miles distant, he found specimens at a slightly lower level. Turning to the south side, he mentions obtaining, in Reading itself, numerous specimens of the discoidal axe-heads from gravel overlying the Palaeogene clays. Together with these he found flakes which had been used as scrapers and two fragments of bone "which had been cut as if by a flint implement, which, when put together, are seen to have formed part of the same bone which had evidently been split before it became embedded in the gravel." From the same bed of drift, which varies from 14 to 19 feet in thickness, he obtained remains of elephant, rhinoceros and horse.

⁶ A. M. Bell, "Palaeolithic Remains at Wolvercote," *Antiquary* xxx.

⁷ O. A. Shrubsole "On the Valley Gravels about Reading." *Quart. Journ. Geol. Soc.* xlv. (1890).

In the North London district from west of Acton (see Allen Brown, "Notes on the High-level Valley Drift between Hanwell and Iver," *Proc. Geologists' Assoc.* xiv., 1895)⁸ to Stoke Newington and Ilford, a vast number of implements have been obtained.

At Acton itself is the site of the first large discovery of Palæolithic implements in the Thames Basin. This was by Pitt-Rivers, who described⁹ his investigations in 1872. They chiefly came from the base of the gravel of the highest terrace. His work has been carried on by Allen Brown, who has discovered old surface planes in this terrace. On one of these, exposed in two small pits in the Creffield Road, he found at about six feet from the surface nearly 400 implements and flakes. It was "evident that there had been a manufactory of Palæolithic implements on this floor, since they were often found together in nests, and they are all as sharp and unabraded as on the day they were made."¹⁰ A complete summary of his discoveries, with a list of other neighbouring localities is given in his book, *Palæolithic Man in N.W. Middlesex* (London, 1887). From the middle terrace (the low-level valley drift is here split up into two distinct terraces, making three in all) he obtained the semi-circular axe-head already referred to. This is one of the several localities in the Lower Thames Valley which have yielded remains of the reindeer.

Even more interesting are the similar discoveries made at Stoke Newington by Worthington Smith, whose researches date back to 1879. Several fully illustrated papers written by Mr. Smith for the Essex Field Club,¹¹ and a *resumé* of his labours is given in his book entitled *Man the Primæval Savage*. These memoirs are most important contributions to our knowledge, and should be consulted by all interested in Palæolithic man, not only on account of the interesting facts and investigations described in them, but also because of the numerous and very neatly executed drawings of implements and sections scattered throughout the papers and book. Many neighbouring localities besides Stoke Newington are mentioned in them.

⁸ P. Crooke and J. Allen Browne have also obtained a number of tongue-shaped and other implements, together with the skeleton of an elephant at Southall. See *Proc. Geologists' Assoc.* 2.

⁹ "On Discovery of Palæolithic Implements in Gravels of the Thames Valley at Acton." *Q. J. G.S.*, xxxiii. (1872)

¹⁰ *Quart. Journ. Geological Soc.*, xlii, also *Proc. Soc. Antiquaries 2nd Ser.* xi. 1887.

¹¹ Worthington Smith: "Primæval Man in the Valley of the Lea," *Trans. E.F.C.* iii. 102, *Essex Nat. I.*, 36, *ib. I.*, 83, *ib. I.*, 125; "Neolithic and Palæolithic Scrapers, Replaced and Reworked," *Essex Nat. I.*, 67; "Palæolithic Implements—Large and Heavy Examples," *E.N. I.*, 97.

Near by, at Ilford, Palaeolithic implements have been found in both high and low level drift.¹²

The patches of high-level drift which extend along the southern crest of the Thames Valley from Wandsworth Common, over Wartford Heath to Swanscombe Hill, at an average height of about 90 feet above the river, have been justly rendered famous on account of the enormous quantity of flint implements which they have from time to time yielded.

From the patch of gravel forming Wandsworth Common, Lawrence¹³ has obtained a large number of implements at a depth of ten feet. They comprise tongue-shaped implements, scrapers, knives and cores, besides about three thousand flakes.

In the Swanscombe gravel pits¹⁴ searchers can always find more flakes than they can possibly carry away with them, and there is not a single large flint to be found that has not been artificially chipped. The flakes are mostly rough and heavy, and none show any evidence of design in their shape. They would appear to be chiefly the result of the preliminary blocking out of the big flints prior to their conversion into the tongue-shaped implements. Scrapers, spokeshaves, and other flake-tools also occur, but they are mostly very rude. The better-known tongue-shaped implements are found in every stage of manufacture, ranging from the nodule, from which only one or two flakes have been struck, to the finished weapon. These last differ very much in size, and exhibit unrivalled diversity of form. Failures and broken implements that have been re-pointed are common. A large number of bones and shells have been obtained from these beds. The Galley Hill patch, now worked away, from which the human skeleton came,¹⁵ belonged to this mass of drift.

Turning to the low-level drift of this tract, there is Spurrell's remarkable discovery of an old working place at Crayford,¹⁶ a locality which is also famous for the abundance of its animal remains, which include lemmings and other interesting small

¹² See Martin A. C. Hinton, "Pleistocene Deposits of Ilford and Wanstead District," *Proc. Geologists' Assoc.* xvi. (1900); and J. P. Johnson, "Palaeolithic Implements from Low-Level Drift of Thames Valley," *ESSEX NATURALIST* xii. (1901).

¹³ In "Working Sites and Inhabited Land Surfaces of the Palaeolithic Period," by J. Allen Brown, *Trans. Middlesex Nat. Hist. Soc.* (1889).

¹⁴ Some account of these sections is given by H. Stopes in his note "On the Discovery of *Neritina* with a Pleistocene Fauna, and worked Flints in High Terrace gravels of Thames Valley," *Journ. Anthropol. Institute.* xxix. (1901).

¹⁵ See E. T. Newton, "On a Human Skull and Limb-bones found in the Palaeolithic Terrace Gravel at Galley Hill," *Quart. Journ. Geol. Soc.* li. (1895).

¹⁶ F. C. J. Spurrell, "On the Discovery of the place where Palaeolithic implements were made at Crayford," *Q.J.S.S.* xxxvi. (1880), and J. P. Johnson, *op. cit.*

mammals (see Newton, *Geol. Mag.*, dec. iii., vol. vii., 1890). Beneath the chalk cliff, against which the brick-earth abuts, he came across a dense layer of flakes. "The uppermost edge of the area covered by them is about 36 feet from the present surface, the lowest nearly six feet lower. This area was thickly covered with chips for the space of about 10 feet north and south, and, as far as I know at present, 15 feet east and west . . . but I expect that it will be found to extend further. . . The flakes are in most cases quite new and clean, always so on the lower side, very slightly discoloured on the upper." He was able to re-construct some of the blocks of flint which had been split up into flakes by fitting together the pieces. These can be seen in the Natural History Department of the British Museum.

Near Northfleet¹⁷ (close by Swanscombe) the same distinguished observer "found a kind of beach on which lay several *hâches*. They lay according to the slope, from five to twenty-five feet below the surface. . . Elephant remains of great size, also those of rhinoceros, bison, horse, etc., are found on this spot. Here perfect *hâches* of five distinct kinds and make were obtained and some unfinished and spoilt examples. I have examined many thousands of flakes and discovered numerous flint hammers and knapping tools with which the *hâches* were made, also some elegant scrapers of peculiar form."

On the other side of the river at Grays¹⁸ implements have been found both in the high-level gravel and in the fossiliferous low-level brickearth.

Leaving the main valley the remaining localities will be more conveniently dealt with in alphabetical order.

The first on the list is Aylesford, where a large number of the characteristic weapons have been found. There are numerous specimens in Benjamin Harrison's collection in the Maidstone Museum, and he shewed me additional specimens when I visited Ightham last year (1901).

At Caddington, Worthington Smith discovered an old working place similar to that at Stoke-Newington. It is probably the most interesting and most thoroughly investigated of all the Palaeolithic "floors" and is fully described in the

¹⁷ "Palaeolithic Implements found in West Kent," *Archæologia Cantiana* xv. (1883) and "On some Palaeolithic Knapping-tools and modes of using them," *Journ. Anthropol. Institute* xiii. (1884).

¹⁸ Hinton and Kennard, "Contributions to the Pleistocene Geology of the Thames Valley," *Essex Naturalist* xi. (1900); also J. P. Johnson, *op. cit.*

work above cited (*Man the Primaval Savage*). In many cases he was actually able to replace on the tongue-shaped implements, the chips and flakes produced during their manufacture.

The discovery of a very large number of implements has been recorded from Farnham but I have not the reference by me at the time of writing.

The only tongue-shaped implement from the valley of the Wandle is that found by myself at Mitcham and recorded in *Science Gossip*¹⁹.

Church has recorded implements in his "Notes on Drift Gravels at West Wickham"²⁰ and my friend Kennard has a large collection from the same locality. They come from a patch of gravel occurring at a slightly higher level than the majority of the valley-drifts and many of them have decided Eolithic affinities.

The deposits of gravel, sand and loam, which constitute the valley drift of the Thames basin, have yielded the remains of one of the most remarkable fauna ever gathered together in so small an area. Bones of animals which are now only met with in different and widely-separated parts of the world are mingled with those of extinct species of elephant and rhinoceros, and with the flint implements of the men who were their contemporaries.

The extinct vertebrates comprise the trogontherium, two species of fellow-deer, three of rhinoceros, two of elephants, and a vole. One of the elephants is the well-known species whose hairy carcasses have been found in the frozen tundras on the further side of the Urals, and of which the cave-men of the Dordogne have left such faithfully-executed engravings.

Those of the existing species which did not survive the Palaeolithic period in this country include such diversely distributed animals as the hippopotamus, spotted hyaena and lion, which are now practically confined to the continent of Africa, and the musk-ox, whose habitat at the present day is restricted to the Arctic regions of North America.

Another group, which includes two voles—*Microtus ratticeps* and *M. gregalis*—the saiga and the souslik, is to-day characteristic of the Steppes. Two species of lemming are also comprised in

¹⁹ J. P. Johnson "Palaeolithic Man in Valley of the Wandle," *Science Gossip*, N. S. vii., pp. 69-71, 177, 221.

²⁰ *Quart. Journ. Geol. Soc.* lvi. (1900.)

this remarkable fauna: the one is now a purely Arctic animal, and the other survives only in Scandinavia.

Two more voles, the bison and bear, complete the list, while the beaver, urus, reindeer, wolf, and another species of bear, which appear to have lived on into the succeeding Neolithic period, must also be mentioned as interesting members of the Palaeolithic fauna.

Of the invertebrates there is at least one extinct species of an Ostracod, a Pelecypod, and a Gastropod, while there are several which, though still living on the European mainland, are no longer inhabitants of Britain.

A complete review of the previous literature relating to the valley drifts of the lower Thames Basin is given by Whitaker in *The Geology of London (Memoir Geol. Survey: 1889)*. This is brought up to date in his Address to the Geologists' Association in 1901.

A tolerably complete list of the invertebrate remains occurring in these beds will be found in the following papers:—W. J. Lewis-Abbott, "The Sections exposed in the foundations of the New Admiralty Offices," *Proc. Geologists' Assoc.* xii., 1892. J. P. Johnson and G. White, "Some new Sections in, and contributions to the Fauna of, the River Drift of Ilford," and J. P. Johnson, "Additions to the Palaeolithic Fauna of the Uphall Brickyard, Ilford," *Essex Naturalist* xi., 1899-1900. Hinton and Kennard, "Contributions to the Pleistocene Geology of the Thames Valley," Part I., *Essex Naturalist*, xi., 1900. Kennard and Woodward, "Post-Pliocene Non-Marine Mollusca of the South of England," *Proc. Geologists' Assoc.* xvii., 1901 (Wartford, Swanscombe, Crayford, and Erith, Green-Street-Green).

Between the laying down of the last of the valley-drifts and the commencement of the deposition of the next series of deposits—the alluvial flats—a great interval of time must have elapsed, an interval sufficient to permit of the extinction or migration elsewhere of the remarkable assemblage of mammals enumerated above, and to allow of the replacement of the characteristic Palaeolithic implements by others of a totally different type.

The newest series of fluviatile deposits in the Thames Basin—the beds of clay, mud, and peat which make up the alluvial

flats bordering the rivers—contain implements and other relics which constitute a record of the third or Neolithic period of the Stone Age. These occur in the lowest and oldest layers only, for the upper beds range in age from the prehistoric bronze and iron epochs right up to historic times.

Of the implements found in the Neolithic alluvium, flakes and flake-tools still constitute the vast majority. The former are always neat and small, and seldom attain the size of the average Palaeolithic flake, while minute examples with three or more faces and a well developed bulb of percussion are not uncommon, which shews that the art of producing flakes had now reached its highest level. The scraping tools bear a general resemblance to those of the earlier periods, but the average of excellence of workmanship is greater.

The other implements, however, are very different. The tongue-shaped and discoidal weapons of Palaeolithic times are replaced by thin, symmetrical and skilfully chipped javelin-heads, which are often neatly and uniformly notched on either side to facilitate the hafting ; by beautifully finished daggers, not unlike the javelin-heads, but usually with a distinct handle worked at the end of the flat blade ; and by axe-heads with a straight or slightly curved ground edge like that of a chisel. The last mentioned are usually more or less polished all over. While evidence of the knowledge of the bow appears for the first time in the shape of often exquisitely finished arrow-heads.

ANCIENT URNS AT BRAINTREE.

By W. COLE.

A DISCOVERY of considerable interest was made at Braintree on September 4th, in the course of excavating a field for building cottages. A workman's pickaxe came in contact with some pottery, about 2 feet below the surface, which proved to be cinerary (?) urns of great antiquity. The site, half-way between Chapel Hill and Rose Hill, is on the immediate north side of the supposed Lake Dwelling described by the Rev. J. W. Kenworthy and others in the *ESSEX NATURALIST* (vol. xi., 94-126) and opposite to the north side of Messrs. Courtauld's silk-mill. One urn, which was unfortunately broken by the pick-axe, contained a quantity of fragmentary

bones, presumably human. This urn is of elongate form and unornamented. The second urn is globular in shape, and ornamented with ribbed bands; it is stated to bear a potter's mark. It was taken out of the earth in excellent condition. Mr. Kenworthy informs me that fragments of the same kind of pottery and bones of the horse and ox have been turning up on this site since Mr. Parmenter began excavations in the spring of this year. He states that he has several pieces of pottery which he took out of the *debris*, and that he thought they were of Roman make. But I understand that the British Museum



authorities put down the urns as "Late Celtic" or Neo-Celtic. Mr. Kenworthy states that fragments of a third urn were unearthed, but it is not known at what depth, or whether in proximity to the others. "The diggers were too rough-and-ready to take observations of particulars of this kind." He adds "the Skitts Hill locality seems to go along with Chapel Hill and to constitute the earliest habitable ground here—as early, at least, as the Neolithic times. The road leading from Chapel Hill is long anterior to the Roman period and to the leading roads now in use. It seems to be an early British road. You

are aware that the Romans had a settlement on Chapel Hill, and that on this site was the village of Braintree until the completing of the Domesday Book. Braintree as we now have it, only dates from the end of the 12th century." I give a photograph of the urns, one of a series taken by Mr. Tilston, of Braintree, and have to thank the Rev. J. W. Kenworthy and Mr. Parmenter for the information embodied in this note. It is very meagre, and serves as an example of the necessity for some such organisation for systematic explorations as that advocated at the meeting of delegates of Local Scientific Societies at Southport. All discoveries of the kind should be taken in hand at once by an instructed Committee and every fragment found carefully localised, labelled, and preserved, so that a really scientific report could be drawn up. We are losing piecemeal year by year valuable material for the "buried history of Essex."

NOTES ON A PALÆOLITH FROM GRAYS, ESSEX.

By A. S. KENNARD.
(With Plate VI.)

THIS implement was found by myself *in situ* in the section of the Middle Terrace gravel exposed in the Globe Pit, Grays. Judging from its condition and the style of workmanship, it does not truly belong to that deposit, but has been derived from the High Terrace, the true Middle Terrace implements being totally different. It is a good example of what is often called the "Moustier" type, from the fact that similar tools were found in the cavern known as "Le Moustier," situate on the right bank of the Vézère, France. The remains from this cavern are considered to show an advance on the period of St. Acheul, but older than any yet discovered in caves. Mr. C. H. Read, F.S.A., has described them as being "marked by a more or less curved cutting edge at one side (hence often called 'side-scrapers'), and chipped, for the most part, on one face only. The chief locality is High Lodge, Mildenhall, Suffolk, but specimens are found elsewhere, as in north-east London, and the peculiar form suggests some connection between palæolithic man of these levels and the oldest cave men of southern France."¹ In the first place, it must be remarked that this type is by no means uncommon in the High

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B

A

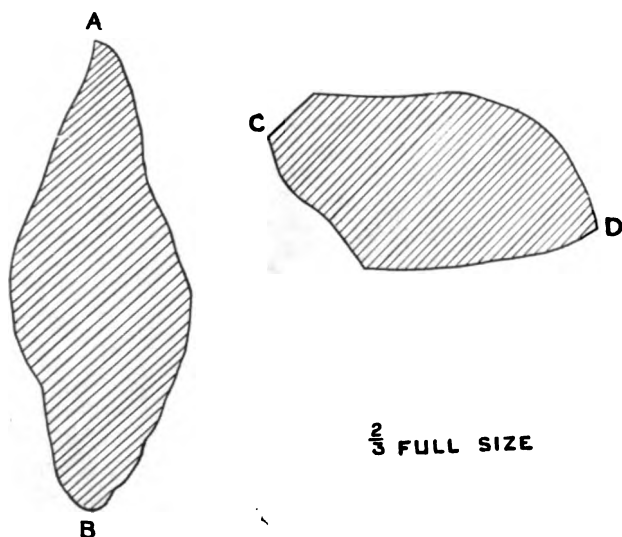
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C

PALTOOTH FROM GRAYS, ESSEX. Actual Size.

Terrace gravels, which are without doubt of the same age as the gravels at St. Acheul. It also occurs in the still older palæoliths, the "Hill Group" of Sir Joseph Prestwich. Hence, in my opinion, this type cannot be considered to be in any sense distinctive of a particular period.

That there is a difference between the tools from Le Moustier and the High Terrace implements cannot be doubted, and judging from workmanship the latter are the older. In my opinion the implements from the Middle Terrace of the Thames are of the Mousterian age. To this period I would assign the



$\frac{2}{3}$ FULL SIZE

LONGITUDINAL AND TRANSVERSE SECTIONS OF THE GRAYS IMPLEMENT,
ALONG THE LINES INDICATED IN PLATE VI.

Palæolithic Floors at Grays, Crayford, and Stoke Newington, some of the implements from Ilford (several of the palæoliths from this locality are undoubtedly derived from the High Terrace), and many other localities outside the Thames area, as at Hoxne, Hitchin, Mildenhall, Caddington, etc.

I have pleasure in presenting the implement above described, to the Essex Museum of Natural History, and I must not forget to thank Mr. F. W. Reader for excellent photographs of the stone.

¹ *A Guide to the Antiquities of the Stone Age in the Department of British and Mediæval Antiquities, British Museum, 1902. Page 28. Two specimens from Suffolk are figured (figs. 20 and 21).*

NOTE ON A NEOLITHIC ARROWHEAD FROM UPTON PARK, ESSEX.

By A. S. KENNARD.

THIS beautiful Arrowhead, which I exhibited at the meeting of the Club on April 4th last (*ante*, p. 87), was found by Master Ernest Tees in the garden of 161, Boleyn Road, Forest Gate. It is an exceedingly well made implement, and has been fashioned from a flake. It is stained a light brown colour, a condition occurring in nearly all the worked flints obtained from



FLINT ARROW-HEAD from Upton Park, Essex.

the surface of the gravels and beneath the alluvium. As may be seen from the figures one of the wings is unfortunately broken. The length of the tang is very remarkable. Flint Arrowheads are rather rare in the Home Counties, in this respect contrasting greatly with their abundance in Suffolk, Yorkshire, and elsewhere.

NOTES ON THE SEEDS OF PLANTS FOUND IN THE ALLUVIUM OF THE RIVER LEA, AT WALTHAMSTOW, ESSEX.

By CLEMENT REID, F.R.S., F.L.S., F.G.S.

With remarks by A. S. KENNARD and B. B. WOODWARD, F.L.S., F.G.S.

THE seeds on which the list is founded, were obtained by Mr. Kennard while working over the alluvial material for mollusca. The reader is referred to the paper in the present volume (*ante* p.p. 13-21) for geological and other details.

Nothing in this list suggests a date earlier than Roman or much newer than Romano-British. The plants correspond closely with those found in Roman Silchester, and include many of the same cultivated species and weeds of cultivation. Grape-seeds show that the deposit containing them is not older than the Roman period. The absence of many common weeds of later introduction, and the presence of the vine, suggest that the deposit is not much newer than Roman, though it is still uncertain to what extent the cultivation of the vine died out after the Saxon invasion.

<i>Ranunculus aquatilis</i> , L.	<i>Viburnum opulus</i> , L.
<i>repens</i> , L.	<i>Polygonum convolvulus</i> L.
<i>Nuphar luteum</i> , L.	<i>amphibium</i> , L.
<i>Vitis vinifera</i> , L. (Grape)	<i>Alnus glutinosa</i> , L.
<i>Acer campestre</i> , L.	<i>Corylus avellana</i> , L.
<i>Prunus spinosa</i> , L.	<i>Quercus robur</i> , L.
<i>domestica</i> , L. (Damson)	<i>Ceratophyllum submersum</i> , L.
<i>avium</i> , L.	<i>Iris pseudacorus</i> , L.
<i>Rubus fruticosus</i> , L.	<i>Sparganium ramosum</i> ? L.
<i>Crataegus oxyacantha</i> , L.	<i>Potamogeton natans</i> ? L.
<i>Eranthe lachenalii</i> , Gmel.	<i>Scirpus lacustris</i> , L.
<i>crocata</i> , L.	<i>Carex riparia</i> , Curtis
<i>Cornus sanguinea</i> , L.	<i>Triticum sativum</i> , L. (Wheat)
<i>Sambucus nigra</i> , L.	

Remarks by A. S. Kennard and B. B. Woodward.

In our paper on the mollusca, cited above, we expressed the opinion that the beds from 3 to 10 feet in thickness were the equivalent of the 60 feet found at Tilbury. Since this statement was made, Mr. T. V. Holmes has published an account (Essex

NAT. xii., p.p. 224-231) of a buried channel at Walthamstow which is without doubt of the same age as the buried channel of the Thames, namely Holocene. Hence it follows that the beds from which we obtained our collection must belong to the later part of the Holocene, and are certainly Post-Neolithic, if not later than the Bronze age. Mr. R. Lydekker, F.R.S., has already pointed out that the remains of Oxen (*Bos longifrons*) from these beds represent a large breed, and therefore are of no great antiquity. Professor Dürst, of Zurich, who examined some remains of the Bovidæ in our possession from these beds, pronounced one skull to belong to the Roman breed of cattle, whilst the others were in his opinion of an equally late date. Thus all the available chronological evidence points to a late date for the origin of the wide spread alluvial beds and in this view we concur.

NOTES ON MARINE ANIMALS OBTAINED IN ESSEX WATERS IN 1902 AND 1903.

By H. C. SORBY, LL.D., F.R.S., F.L.S., &c.

AS might be expected, this present summer has been extremely bad for collecting, but still I have been able to obtain a few animals which I had never before found in Essex.

Until I collected a number in the Orwell in Suffolk, *Terebellides stræmii*, Sars, had not been found in Britain for over 100 years, and then only a single specimen. This year for the first time I obtained a fine one in the mud of the Colne, a short distance below Brightlingsea Creek. We there also found a single specimen of the Planarian worm *Lineus gracilis*, Johnson. Near the "Stones" at East Mersea, we found for the first time a good example of *Lineus obscurus*, Desor., which I had never seen except in the extreme limits of the county, in the mud of the River Stour, at Mistley. These Nemertians can elongate themselves in a remarkable manner, and may be killed well extended by adding a little menthol to the sea water in which they are kept. When transferred from salt water to fresh, their surface is quickly altered into a white mucus; and I was very sorry not to find other specimens, in order to ascertain whether the whole animal is so changed. This year by dredging off Mersea, I obtained a single specimen of *Haminea (Bulla) hydatis*,

of which I found three last year, being an addition to the list of Essex mollusca. Though I had dredged over the same ground for many years, not a single specimen had ever been found previously. Last year I collected for the first time in the River Colne a number of the beautiful blue Medusa, *Cyanea lamarchii*.

NOTES ON ANCIENT WATER-PIPES.

By A. MORLEY DAVIES, B.Sc., F.G.S.

THE following notes are offered as a supplement to Mr. T. V. Holmes's interesting article on "Tree-Trunk Water Pipes" (*ante* pp. 60-75).

I think it will be found that there was no *extensive* use of elm-wood pipes in or about London before the time of the New River. All references to water-pipes during the middle ages that I have seen refer to them as of lead. The earliest known plan of a system of water-pipes is probably that of the Monastery of Christ Church in Canterbury, which dates from before 1167. It is preserved at Trinity College, Cambridge, and reproduced in Willis's *Architectural History of the Conventual Buildings of the Monastery of Christ Church in Canterbury*. In a record quoted in that work the water is said to be brought from the distance of a league outside the city "tut suz terre par pypes de plum."

These leaden pipes were doubtless made in the same way as those found at Pompeii, which are pear-shaped in cross section, and made from sheet lead folded together (Mau's *Pompeii: Its Life and Art*).¹

Leaden pipes seem to have been used for the early conduit pipes in London from 1236 on. The accounts of the Keepers of the Conduit in 1350 include 8 marks and 12 pence for one "fozer" (about a ton) of lead, but there is nothing about wood (Riley's *Memorials*, p. 265.) When extensive works were about to be undertaken by the Corporation in 1443, the Royal Charter granting them the necessary rights allowed them to "commandeer" 200 *foudras plumbi*. (Rymer's *Foedera*, vol. xi. p. 33.)

John Norden in his *Surveyor's Dialogue* (1607) describes an imaginary survey of a manor, which is of great value as a picture of country life at the time. When the Surveyor is approaching the manor-house, he remarks:—

¹See note on the invention of method of casting pipes of lead, *ante* p. 75.—Ed.

"I see the conducts are made of earthen pipes, which I like farre better than them of Leade, both for sweetnes and continuance under the ground." p. 85.

From this we may gather that earthenware pipes (which are no doubt meant by "earthen") were a comparative novelty, and that wooden pipes were either altogether unknown to Norden or that he did not consider them worth mention.

I take the following quotation at second-hand from Gilbert White's *Selborne* (footnote to Pennant Letter VI.²)

"November 29, 1731, a little snow having fallen in the night, it was, by eleven the next morning, mostly melted away on the surface of the earth, except in several places in Bushy Park, where there were drains dug and covered with earth, on which the snow continued to lie, whether those drains were full of water or dry; as also where elm-pipes lay under ground. . . ."—See Hale's *Hæmastatics*, p. 360.

Much information regarding the use of elm-wood pipes by the New River and other London water companies, their disadvantages, and the date of their replacement by iron pipes, may be found in Matthews's *Hydraulia* (1830.)

NOTES ON THE PRESENT-DAY USE OF WOODEN WATER-PIPES.

By E. DICK, *Clacton College*.

IT may interest readers of Mr. Holmes' paper in the *ESSEX NATURALIST* (*ante* pp. 60-75) to hear that wooden water-pipes are still largely used in certain country districts of Switzerland. In my native village, which is situated in the lower part of the Bernese "Emmenthal," the water is supplied both by conduits and by pumps that are made of wooden pipes.

The water which feeds the "running fountains" comes from a source about $1\frac{1}{2}$ miles distant. The pipes are exclusively made of medium-sized unbarked fir-trunks, and from sixteen to twenty feet long. In order to prevent their splitting, they are bound at either end by iron bands; iron bands are also driven inside the aperture. I could not tell how long the pipes last, but I remember that frequent repairs were necessary.

As it is, of course, not possible to bend the pipes, "water-chambers," *i.e.* square pits laid out with bricks or cement and

²This is really portion of one of Sir William Jardine's notes in his edition of *Selborne* 1853.—Ed.

about two inches deep, are dug out at the places where the conduit must take a turn ; these chambers act as a sort of small reservoirs from which the water at once flows off in the desired direction. These water tanks also serve the purpose of the more modern man-holes.

In addition to the running fountains they have in many houses a pump, also made of wooden pipes. The wells are of a good depth, say 35 to 45 feet. Not only the pipes, but the piston rods as well, are made of fir-wood. Similar wooden pumps are besides used for other purposes, as, for instance, to pump out the storage pits of liquid manure on farms.

To mention yet another use of wooden channels to conduct water : the houses, wooden from end to end, have wooden gutters, which are chiselled out of rather thinner but long fir-trees, fastened to the shingle roofs.

In our villages perfectly straight pipes are made, and the boring is done entirely by hand. This work requires strong hands and a good deal of skill ; it is mostly performed by professionals, but the farmers supply the raw material.

The tree trunk, already bound with iron bands at either end, in order to prevent its splitting, is firmly fastened on two carpenter's benches, at the height of about four feet from the ground. I forget how it is fastened, there may be several ways of doing it well. The boring is started with a small drill, so as to make it easier to drive in the large and heavy borer that is to give the pipe the necessary calibre. The borers are of good material and very sharp; they have shafts long enough to reach a little further than the middle of the length of the trunk. A long handle of strong wood can be pushed through a hole in the shaft, like a thread through a needle. At some distance from the trunks, where the boring is to begin, the shaft is made to rest on a support with an iron groove, which can be raised or lowered. This support is placed so as to bring the borer exactly into the boring line and then made fast. The borer is applied to the trunk, where one man must hold it with his hands whilst two others begin to work it. At first they proceed very gently and slowly, and frequently ascertain whether they are in the proper lines. As they advance, however, the danger of a deviation becomes less, whilst the men have to use all their strength to force the heavy implement through the

wood. One half of the pipe being done, they complete it by boring in the same way from the other end¹.

The pipes when finished are thrown into a pond, where they swim undisturbed until they are wanted.

MEETING OF CORRESPONDING SOCIETIES' COMMITTEE OF THE BRITISH ASSOCIA- TION AT BELFAST, 1902.

MR. W. WHITAKER, F.R.S., kindly acted as Delegate of the Essex Field Club at the Belfast Conference, and he gave at our meeting in November last a short verbal summary of the proceedings. Owing to the delay in the issue of the printed Report of the Conference it has not been possible to give, until the present part of the *ESSEX NATURALIST*, our usual account of the proceedings. Now that the British Association's Belfast volume is out, and on our library shelves, it will be sufficient to quote from the report some passages which more particularly concern and appeal to the members of our own club.

At the first Conference, on September 11th, 1902, the Chairman, Prof. W. W. Watts, M.Sc., Sec.G.S., delivered a very interesting address. In alluding to the *raison d'être* and functions of these annual conferences, he said : —

“First and foremost in my belief comes the fact that this Conference is the only body which gives a kind of corporate existence and standing to the Local Societies as a whole. It is the only thing which brings the Societies into touch with one another, and it is the only hope that at present exists for united action and systematised work. That delegates should make acquaintance, meet in friendly intercourse, and compare notes as to work done by themselves and one another is also a good side of our gathering, which is capable of further development than it has yet received.

“Secondly, the annual printing of a list of Societies known to be doing important work, with an index of their publications, is a most useful guide to those desirous of working up the literature of any area. The publications are always of limited issue and still more limited circulation, and they are most difficult to obtain a few years after date. The Association has most wisely treasured the publications which have been sent to it, and it is to be hoped that this nucleus of a valuable and unique collection will be placed where it is widely accessible.

¹ Compare Evelyn's account of the making of wooden water-pipes, in the “Notes” in the present part.—Ed.

"Thirdly, comes the stimulation of mutual example and rivalry. The Local Societies are especially noted for their wide-reaching aims and the all-embracing list of subjects which they pursue, not less than for the steady, persevering persistence with which they will follow up lines of inquiry often as tedious as they are important. Again, local facilities or individual genius often place one society or other on some bias or enabled it to do brilliant work in some one direction. The force of such example is never lost upon the other societies, who may extend and even amplify the results thus obtained.

"In the fourth place, the Conference has the power, too little used, to ask for grants, and hence to back those of the Sections. This should have the effect of helping on those researches which have a local bearing.

"In the last place the Association itself profits in receiving each year delegates from all over the country, being thus aided in maintaining the cosmopolitanism which is one of its leading characteristics.

"On looking through the proceedings of the Conference since its beginning, I have been struck by the appositeness and importance of the subjects brought before its consideration. I know that you will not all agree with me on this point, but my distinct impression is that the distinguished men who have served as your secretaries have brought much skill and judgment to the task of selection. An improvement might be suggested, all the more readily as it rests in your own hands. I should like to see each year at least one delegate bring up some topic which has been treated with conspicuous success by his own Society—not merely a few casual words dropped into a discussion, but a considered paper dealing with the technique of an investigation, its difficulties and pitfalls, and some of the conclusions to which it is leading. Suggestions, whether from the inside or outside, as to a desirable piece of work which might be carried out, are usually barren, unless somebody has actually made the experiment and can give hints, warnings, advice, and suggestions for improvement."

* * * * *

"Then we have museums in the country containing collections of considerable local interest, and this suggests a further topic. Many societies are handing over their museums to county and town councils, in some cases with considerable success. I would suggest to societies that they should retain a large share in the control of such museums until the town and county authorities have been thoroughly tried.

At rare intervals there arises in most localities someone with a keen passion for museum arrangement and management. Treasure such a person for all he is worth; work him, unmercifully if necessary, but work him hard; give him a fairly free hand; beg, borrow, or steal for his wants; and get everything you possibly can out of him while he lasts, for such persons die young. If once a museum is got into thorough order, made accessible and attractive, the good effect may last for half a generation—possibly until another prodigy or the paid curator arrives."

After referring to the many subjects annually brought under the notice of the Conferences, Prof. Watts thus spoke of some useful and feasible branches of local geological work :—

"The first geological survey of the country is now nearing completion, and in the maps there is a wealth of raw material for the local investigator. No one knows better than the geological surveyor that his work is only just begun when

he has got the lines upon his map; but an impatient Government calls him elsewhere, and he is only too willing to hand over his maps and the threads of his ideas to the local investigator to work out. The further division of the strata, the zonal collection of the fossils, the relations and origin of the igneous rocks, and the fascinating problems relating to the origin of the landscape features, all become for the first time possible with the completion of the 1-inch map.

"After the survey, new wells, borings, cuttings, quarries, and other sections are opened up, and the Local Society can do excellent work either in the person of the local geologist or, if there be no such person, by giving information, which is always gratefully received and generally acted upon, to the office of the Survey.

"As examples I may mention the examination of many new railways, pipe lines, sewers, and other works which have been studied and reported upon locally or from the Survey Office. Previous to the survey of Charnwood Forest nobody knew that the Mountsorrel granite had been sculptured by desert wind-storms in Triassic time. But suspecting that such would turn out to be the case, I asked local observers to watch the excavations, with the result that in a few years the necessary evidence was forthcoming."

* * * * *

Then, the important subject of abysmal geology was given as one in which the local observers could aid by reporting on all well-borings made in their districts, and the Chairman concluded :—

"The relations of geology and landscape can only be satisfactorily worked out by the local observer, who knows the country in every aspect, and who has time to visit and revisit. This line of enquiry may be expected to yield many new and important results to local enquirers in the next few years.

"But the main geological function of the Local Societies is to keep a watchful eye always open. Every new section brings some new information, some alteration or confirmation of previous opinion, some chance for fresh investigation. It is always better that the cream of such work should be skimmed by the local observer if possible, but if he is non-existent it is the plain duty of the society to call in help from the outside."

At the second Conference, on September 16th, many subjects considered suitable for local societies to undertake were brought forward, for the list of which the reader may be referred to the official report. Mr. G. Coffey, as delegate from Section H (Anthropology), brought before the Conference a letter referring to the destruction which is going on on Dartmoor by removing stones from certain ancient monuments for road repairs! This, and Mr. Charles H. Read's paper, which is abstracted in another place in the present part, gave rise to a discussion on the protection of ancient monuments, and the following recommendation was passed on the motion of the Rev. J. O. Bevan :—

"From communications received relating to the destruction of earth-works and other historic and prehistoric remains, this conference is rendered sensible of the necessity for the systematic indexing of important anthropological remains, county by county, with a view to their preservation. It therefore commends the collection of material to Local Societies, and expresses the hope that steps may be taken to co-ordinate the various elements involved, and to arrange for the publication of the work."

Subsequently in view of Mr. Coffey's and Mr. Read's remarks on the vandalism on Dartmoor, it was resolved to refer the following to the General Council of the Association :—

"That the Council be requested to impress upon his Majesty's Government the desirability of appointing an Inspector of Ancient Monuments under the Ancient Monuments Act in the place of the late Lieut.-General Pitt-Rivers.

"That the Council be requested to call the attention of his Majesty's Government to the destruction of Ancient Monuments, especially on Dartmoor, which is authorised under the terms of the Highway Act, 5 & 6 Wm. IV., c. 50, the provisions of which are unrepealed by later Acts ; and to urge the repeal of this section of the Act."

"A PLEA FOR AN ORDNANCE MAP INDEX OF PREHISTORIC REMAINS."

AT the Conference of Local Scientific Societies (British Association Meeting), Belfast, a paper having the above title, was read. It is from the pen of Mr. Charles H. Read, F.S.A., Keeper of the Department of British and Mediæval Antiquities at the British Museum. Similar arguments to those advanced by Mr. Read have been put forward from time to time, notably by Prof. Meldola in his Presidential Address, 1883 (*Trans. E.F.C.* iii., 62), repeated in an expanded form at the Southport meeting of the British Association in the same year (*Trans. E.F.C.* iv., 116). And, subsequently, Mr. Read himself gave an address to the Essex Field Club at the meeting in January, 1902, on the subject of "Local Archæological Investigation" (summarised in the *ESSEX NATURALIST*, vol. xii., pp. 252-3). We now propose to supplement these remarks by extracts from the Belfast paper, Mr. Read's official position, as the representative of British Archæology, giving a value and force to his pleas beyond anything that can be said by laymen.

After alluding to the attention lately bestowed upon the preservation of Stonehenge, Mr. Read continued :—

"It is not of Stonehenge that I wish to plead, but rather for its humbler brethren whom the breath of fame has for the most part passed over. I plead

for the preservation and intelligent exploration of the many hundreds of remains and sites, of approximately the same period, that are scattered nearly over the whole of our islands.

"Britain is not very extensive when compared with the domains of our Continental neighbours. In Roman times it was regarded as very distant from the centres of civilisation, and the very name spelt something like exile to the luxurious Roman officer. But the Roman never thought, and we ourselves, nearly twenty centuries later, are only beginning to realise, how many races had peopled these distant misty islands, one race overcoming the other, intermarrying or supplanting each other, but in any case living their lives here, building their houses, exercising their simple crafts, and finally laying their dead to rest in the manner prescribed by their own peculiar customs. Of all these primitive peoples who lived in Britain for many, many thousands of years before the Roman invasion we have scarcely a word of history. One after another they passed in succession, leaving no mark in the world's history and no trace in the land beyond the humble tumulus for their burial-place or the sacred ring of stones for their temple. Practically until the Roman historians take up the story of Britain there is nothing existing that can be called history. Britain before the Christian era was regarded as a dangerous and entirely inhospitable land whither no sane man would willingly go, only valuable in fact for what could be brought away from it.

"By what means therefore are we of this twentieth century to realise the conditions in which our pre-Roman forefathers lived? How are we to construct a true history of their arts of life, their beliefs, their dwellings, or their handicrafts? Unless we are far more careful in the future than we have been in the past, the evidence now available will be swept away, and the story of the Britain of the Britons can never be told.

"Our only means of elucidating and making clear the prehistoric condition of our country is by the careful and intelligent exploration of the sites of the dwellings, camps, burial-places, or religious structures raised by the people of those times. By no other method than this can we attain to the knowledge we need, and it should be borne in mind by all who undertake exploration of this character that they have in hand, as it were, a unique record; a record, moreover, that is destroyed in the reading; and if the investigator cannot interpret it aright he destroys for ever a page, it may be, of human history, and no one following him can write it afresh. No explorer, no matter how experienced, can predicate what may be the evidence he will have put before him in the excavation of a simple mound or stone circle, and the greatest care and attention are essential if he desires his exploration to be moderately successful.

"Here then we have, scattered in almost every parish in the United Kingdom, the raw material, the original documents, from which it is the duty of the archaeologist to weave the story of prehistoric Britain. But what are the present conditions of these precious documents? What attention is given to the mounds that cover our downs, to the less prominent stone circles that are to be found scattered over our moors? It is true that monuments of the imposing dignity of Avebury, Stonehenge, and others of great size, are not likely to suffer from wanton damage because, like some human beings, their very size is their protection. It is true also that in some localities of the more enlightened sort committees have been formed and the local societies have been active, for the express purpose of preserving these little noted relics. But vast areas remain, full of prehistoric sites,

in which nothing is done in the nature of preservation ; and, on the other hand, agricultural operations, building, and the like, are doing a great deal in the way of destruction."

Mr. Read gave a very striking local Irish example of the destruction of an ancient cairn, known as the "Giant's Grave," in co. Antrim, and pointed out that the protest of the Dartmoor Committee showed that the law (under the Highway Act, 5 and 6, Wm. IV., c. 50) actually aids and abets public officials in the systematic destruction of our prehistoric remains if, by chance, *stone* be used in their construction ! Mr. Read asks, "is it possible to conceive of a situation more absurd than that shown by the existence in the same statute-book of two such Acts as the Ancient Monuments Act on one hand and this mischievous Act on the other ? The one rigidly protects the very same class of monuments that may be destroyed with impunity by virtue of the other."¹

The writer continued :—

"The danger to other remains, however, which may not be made of stones is equally great, though from other causes. The burial-mounds, mere heaps of earth that are spread more or less over the whole country, are constantly being destroyed, by accident or design, and their story is fully as important as that of any other class of prehistoric remains. The operations of agriculture are daily reducing such mounds to the general level of the surrounding land, and when the burial is at last exposed by the plough the relics are, in almost every case, scattered or destroyed, either in wanton mischief or from ignorance. It is a common thing for odds and ends from such sites to be brought to me at the British Museum, with the story that there was a great deal more found, but that they were divided among the farm hands or given to chance visitors.

"That such a state of things should be general in this country is not creditable to our civilisation. Every modern state with any pretensions to culture takes pains to preserve the memorials of its past, and takes a legitimate pride in the preservation of its ancient monuments. In Britain we cannot claim the same glories of architecture of early times that are to be found in the Mediterranean area. Our modern history has its glories, architectural and of other kinds, but these may safely be left to the guardianship of public opinion. Public opinion, however, can scarcely be said to exist with regard to such of our monuments as are contemporary with the classical period of Greece. They are in the main neither generally known nor understood, and it cannot be said that they are immediately attractive. Nevertheless they are all we have to represent a page, or perhaps a volume, of our country's progress, and as such are deserving of attention and of preservation."

¹ At the discussion at the meeting of the Conference, the Rev. J. O. Bevan said that "it was monstrous, *e.g.*, that on such an important area as Dartmoor the highway authorities were permitted to appropriate valuable remains and break them up for the metalling of roads ! Such an Act of Parliament ought to be at once rescinded. Public opinion should be roused in reference to the entire subject, and Local Societies, such as those they represented, could do a great deal." A resolution, asking the Government to consider this matter, was passed. See page 123.

Mr. Read then proceeded to describe a plan which would in some measure tend to avert the dangers to which he had called attention. He proposed that the active co-operation of the various local societies should be secured, each to make a survey of its own county, and to record on a large-scale ordnance map, every tumulus or earthwork within that county or area : —

“ At the same time a register of the sites, with numbers referring to the map, should be kept, and in this register should be noted the names of the owner and tenant of the property, as well as any details which would be of use in exploring the tumuli. I am well aware that a survey of this kind has been begun by the Society of Antiquaries of London, and is still in progress ; but this is of a far more comprehensive character, and is, moreover, primarily intended for publication. The more limited survey I now advocate would in no way interfere with it, but, on the contrary, would provide material for the other larger scheme. Once the Local Society is in possession of the necessary information just referred to, it would be the duty of its executive to exercise a beneficent control over any operations affecting the tumuli, and it may safely be said that such control could in no way be brought to bear so easily and effectively as through a Local Society.”

NOTES—ORIGINAL AND SELECTED.

ZOOLOGY.

MAMMALIA.

New Forest Life in Winter.—There is an article with foregoing title in the *Spectator* of January 3rd, 1903. The writer speaks of the New Forest as being “ singularly devoid of life,” and notes especially the scarcity of birds and small quadrupeds there in winter ; though foxes are numerous, rabbits are scarce. He remarks that Epping Forest swarms with rabbits, and comparing the two forest areas, says : —

“ Indeed there is more wild life, including rabbits, badgers, jays, pigeons, and wild duck of various kinds, in the small area of Epping Forest and Wanstead Ponds, a few miles from London, than in double that space of the average New Forest area. The writer, for curiosity, tried many hundreds of acres in different parts with an ‘ all round ’ setter, used to ground game, both woodland and heath, and except near two small warrens, found only three rabbits and three pheasants in as many long walks. The only quadruped at all common is not conspicuous. It is the mole. There must be squirrels, for the ground in many of the plantations is strewn with the cores of pine-cones they have eaten ; but even the squirrels do not show.”

BIRDS.

Great Spotted Woodpecker at Fowlness with Notes on the Natural History of the Island. — On September 26th, 1903, I received by post from Mr. Matthams, of Fowlness, a specimen of the Great Spotted Woodpecker (*Dendrocopus major*), which had been shot on the island. It was a bird of the year, but unfortunately it was too stale for preservation. Mr. Matthams informs me that in default of a tree it was overhauling a linen-post, and he believes it was a "foreigner." This is probably true, as September is the season for the autumn migration. The letter containing this information is so full of interest that I propose to make some further quotations from it. He says that Fowlness is a landing-place for a number of birds, a statement I can fully corroborate, as I have never seen, in a day, so many hawks, large and small, as I have observed at this time of the year in that island. Mr. Matthams says also that in October of late years there have been, in addition to many other birds, large numbers of crows and rooks arriving, accompanied by an abundance of jackdaws. There are generally said to be French, but, wherever they come from, the numbers passing over in a day may be reckoned by hundreds. Some few years ago they had to fly against a very strong north wind, and several were seen to drop in the water, only a few hundred yards from land. Referring to the high tide of a few years ago, which flooded so much marsh land in Essex and Kent, Mr. Matthams informs me the land is slowly coming round now, and that he should have had a very fair crop this year had he not been pestered with wire-worms. They cleared the crops on some marshes right off. He sowed one marsh with oats again, but the wire-worms destroyed that crop also, and he expresses his surprise that the flooding with salt water did not destroy all such life. But these are not the only vermin that have been troublesome; for the second and third year after the flood the land swarmed with "sow-bugs," as they call woodlice there. Where they came from was a puzzle. On reading these remarks, I think it will be felt that it is much to be regretted there are not more of such intelligent observers throughout the country. I know I felt the want very much when compiling my list of the fish, etc., of Essex, and I hope Mr. Matthams may long be able to observe and report other interesting matters occurring in his

district, a parish sadly neglected by those interested in the natural history of Essex, whether their favourite subjects be birds, fishes, or insects.—HENRY LAVER, F.L.S., Colchester, October 2nd, 1903.

INSECTS.

Calosoma sycophanta, L.—Master R. H. Stevens recently brought up to the museum, and presented to me, a fine specimen of this insect, the rarest, largest, and most beautiful of the British Carabidæ, or Ground-beetles. It had been caught at the end of July by his father, Mr. E. Stevens, on the site of a new Church, of which he is the architect, now being built in Half-mile Lane, Northwood, near Pinnar, Middlesex. Mr. Stevens writes that the beetle was crawling on the grass by his temporary office, and at once attracted his attention by its brilliant colours, unlike any insect he had seen before. *C. sycophanta* is usually found on the coast, and the specimens have been supposed to be immigrants from the Continent; its occurrence so far inland is, therefore, remarkable and worthy of note here, although it is not an Essex specimen. Curiously enough, another specimen is registered this month in the *Entomologists' Record*, by Mr. W. H. Bennett, F.E.S., who found it in August, at Battle, in Sussex, seven miles inland.—W. COLE, September, 1903.

Sirex gigas at Buckhurst Hill.—Among the curiosities of the gnat visitation about the middle of August was the production to me of a specimen of this insect, which had startled a maid-servant by flying to the light in her kitchen. Her mistress promptly identified it by a picture in a daily paper as one of the "mosquitoes" which had rendered night hideous to them for a week or more. As the *Sirex* was a fine female, measuring about two inches, with a practicable-looking, sting-like, ovipositor, the ladies' alarm at the possibility of a swarm of such midnight marauders was apparently justified!—W. COLE.

Locusta viridissima.—A female example of this fine Orthopteron was brought up to the Museum, taken on the banks of the Thames near Purfleet, in August last. This insect is probably far from uncommon on our coast, but is very rarely detected, in spite of its large size; its colour and habits very effectively favour concealment.—W. C.

The "Painted Lady Butterfly."—Perhaps the most notable event on our coast during this "un-entomological" autumn was the abundance during the last few days of the beautiful insect, *Cynthia cardui*. Neither my brother nor I have ever seen anything like it. Strong S.E. winds had been blowing, and on one or two bright sunny days, scores were flying in one view in a clover-field on the St. Osyth coast, and they were quite common even in the town of Brightlingsea. I saw many at Buckhurst Hill and in other parts of the Forest. Forty years ago the capture of a *Cynthia* was a rare event; one to be recorded with jubilation in the natural history journals; last week five or six could be caught with a sweep of the net. The majority were much "worn" and some quite battered. The other *Vanessidæ* have been uncommon, only occurring singly, with the exception of *V. atalanta*, of which moderate numbers have been seen. As usual in "*cardui*" as well as in "*edusa*" years, the lively little day-flying moth, *Plusia gamma*, has been swarming all round our coast.—W. COLE, September 26th, 1903.

Since writing the above, our member Mr. F. W. Elliott, has kindly sent me a number of newspaper-cuttings from which it appears that the apparition of *C. cardui* has been observed in many parts of the country, mainly on the E. and S.E. Coast, and even in London itself. A few sample extracts may be given. Mr. F. C. Warburg wrote on September 26th:—

"In a sunny spot in Hyde Park, on a bed of *Sedum spectabile*, I saw yesterday at midday four Painted Lady butterflies, *Cynthia cardui*, sunning themselves with outspread wings or sucking the honey from the flowers. The same bed, besides innumerable flies and bees, had attracted one Red Admiral, *Vanessa atalanta*, while two 'Silver Y's,' *Plusia gamma*, were hovering over the flowers. On a neighbouring sunflower was another *cardui*, and close by two more were settled on another bed of *Sedum*. Of the seven *cardui* only one had a wing clipped, and all the others were in good condition, though not quite fresh. I have never seen *V. cardui* in London before."

Mr. Milne, Westgate-on-Sea, counted fifty-one "Painted Ladies" on one flower-bed, and Miss Vernon-Wentworth wrote from Blackheath, Saxmundham, Suffolk:—

"At this place, which is on the East Coast, about three miles from Aldeburgh, Painted Lady butterflies have been, and still are, flying about in swarms, the air being quite full of them sometimes. On one plant of Michaelmas Daisy I counted as many as sixteen together. I have also noticed what was mentioned by one of your correspondents—the battered condition of some of them owing to the violence of the wind which blew them over."

Similar experiences are recorded in the *Entomologist and Entomologists' Record* for October. Records are given from Bexley and Strood (Kent), Reigate, Chiselhurst, and Ilford. The Rev. Gilbert H. Raynor writes:—

"I saw at least fifty specimens of this beautiful insect disporting themselves on the flowers of *Sedum spectabile* in the garden of Woodham Mortimer Place, Essex, this morning (September 21st). The *Sedum* is planted in a row some thirty yards long, to form the border of a flower-bed. Here and there, among the *Cardui* flashed out the vivid scarlet of *Vanessa atalanta*, and there were simply hundreds of humble-bees and hive-bees, not to mention that common autumn imitator of the latter, *Eristalis tenax*. Truly a wonderful and magnificent sight, and long to be remembered."

The most probable explanation of this abundance of the butterfly is that, like other species occasionally (e.g. *Pieris brassicae*) it is a visitor, voluntary or involuntarily, from the Continent¹. A very qualified observer in Essex, Mr. G. F. Mathew, R.N., F.L.S., writing from Dovercourt on September 23rd to the *Morning Post*, very pertinently remarks:—

"The strong south-easterly winds which have been blowing continuously on this coast for the past four days have brought on immense number of the Painted Lady butterfly (*Cynthia cardui*) across the North Sea. Two days ago not one was to be seen, but on Tuesday last, notwithstanding that there has been scarcely any sun, they are in hundreds everywhere. It is a large bright-coloured butterfly, as I daresay many of your readers know, and not one to be easily overlooked. A few are generally seen every year at this time, and after a hot dry summer they are often abundant, so it is strange they should be so plentiful after the wretched weather that has prevailed during the past season. These are not newly-hatched butterflies, as many of them are weatherbeaten, nor are they likely to be immigrants, for immigration, as a rule, only takes place after a long continuence of hot weather. They are only wanderers blown across, whether they wished it or not. The common Gamma moth (*Plusia gamma*), of which only a few were to be seen a day or two ago, was also swarming on Tuesday—another case of enforced immigration."

And lastly, from Whitby, Yorkshire, Mr. W. L. G. Bennett writes:—

"It may interest Mr. Mathew to know that the *Vanessa cardui* is very plentiful at and near Whitby, which seems to favour his supposition that they have been blown over the North Sea. There have been this summer from the

¹ Coleman, in his *British Butterflies*, records an extraordinary flight of the small white butterfly (*Pieris rapa*) crossing the Channel from France to England. "Such was the density and extent of the cloud formed by the living mass that it completely obscured the sun from the people on board our Continental steamers on their passage, for many hundreds of yards, while the insects strewed the decks in all directions. The flight reached England about noon, and dispersed themselves inland and along the shore, darkening the air as they went. During the sea-passage of the butterflies the weather was calm and sunny, with scarce a puff of wind stirring, but an hour or so after they reached *terra firma* it came on to blow great guns from the S.W., the direction whence the insects came." A great immigration of *Pieris brassicae* on to the Essex coast, observed by Mr. F. Kerry, is recorded in the *ESSEX NATURALIST*, vol. vi., p. 205.

East several violent storms which might easily have brought them. I have not seen a single specimen in Surrey this year, but here they seem to be the commonest butterfly."

With a change of wind to furious S.W. gales, and torrents of rain, the butterfly and moth quickly became rarer, and on a long walk through St. Osyth parish on October 14th, scarcely one was to be seen, where hundreds had been previously.—W.C.

Bats Catching Moths.—In continuation of the observations given in the *ESSEX NATURALIST* last year (*ante* pp. 42-3) we have again this summer remarked the wings of many species of moths on the floor of the verandah at my house at Buckhurst Hill. Most of the species recorded before have been noticed, with the following additions, making 25 species in all:—

<i>Arctia lubricipeda</i>	<i>H. oleracea</i>
<i>Apamea ocella</i>	<i>Plusia chrysitis</i>
<i>Xylophasia lithoxylea</i>	<i>Ourapteryx sambucaria</i>
<i>X. polyodon</i>	<i>Abraxas grossulàriata</i>
<i>Hadena dentina</i>	

The destroyers were certainly bats, as they were constantly "hawking" in and about the verandah in the evenings, and the "signs" of their resting places were plainly to be seen under the eaves. Gilbert White, in his eleventh letter to Pennant, wrote, alluding to a tame bat which was fed with insects, "the adroitness it showed in shearing off the wings of flies, which were always rejected, was worthy of observation, and pleased me much."—W. COLE, September, 1903.

BOTANY.

Notes on Essex Plants.—I send a few notes, which may be of interest:—

Vicia lutea.—A plant of this species, with nearly white flowers was found on the seawall at Goldhanger, on Saturday, August 8th. It is a curious coincidence that two persons should be able to record the finding of this plant in consecutive issues of the *ESSEX NATURALIST*. Within a very short distance one came across two other plants, viz.: *Bupleurum tenuissimum* and *Typha latifolia*.

Valerianella auricula.—It is a pleasure to be able to record another county district for this species (District 5), as it was

found at Billericay in a barley field with a clover bottom, on Saturday, July 25th.

Petroselinum segetum occurs just out of Witham on the side of the main road to Colchester, but in the parish of Faulkbourne (a narrow strip of this parish crosses the road here and joins Little Braxted). I have also found it sparingly on the bank of a pasture adjoining Witham Vicarage. It would be of interest to have records of the present distribution of this plant in the county, as, no doubt, it is often passed by for *Sison amicum*, which is very common in the surrounding parishes.

I have also had two plants sent me by the Rector of Belchamp Otten, one of which, *Orchis pyramidalis*, may be added to the county flora as occurring in District 2; and the other, *Geranium sylvaticum*, does not appear to have been recorded before for any district in Essex.—EDWIN E. TURNER, Coggeshall, August 10th, 1903.

"Alien" Plants at Manningtree.—At Manningtree, on July 18th, 1903, on the margin of the pond near the railway station, I found, in addition to the usual flora, the following plants:—*Matthiola bicornis* (not in the British flora) *Asperugo procumbens* Linn., *Phalaris canariensis* Linn., *Cynosurus echinatus* Linn., and *Torilis nodosa* Gaert., while some plants of *Medicago sativa* Linn. were close by. These are, of course, with the exception of *Torilis nodosa* Gaert., so far as my experience goes, a somewhat uncommon plant in this county) aliens in the district, and were probably introduced with foreign seeds, but the interest of the matter will be to see whether they will maintain themselves in the position, and if so how far they will spread. In the near neighbourhood two plants, which it seems reasonable to suppose are not really natives of this county, although frequently met with, viz.: *Melilotus officinalis* Desr. and *Erypinum cheiranthoides* Linn., are abundant and have been so for a considerable time. Perhaps some botanist in the district will next year be good enough to examine and report upon their occurrence or otherwise then.—FRED. J. CHITTENDEN, Biological Laboratory, Chelmsford.

New Essex Fungus Pests.—Very recently, a large, fleshy fungus, called *Hydnum schiedermayeri*, has been developed on an old apple tree at Maldon, bursting through the bark in a long

strip extending for three or four feet, in an irregular mass. It has a nodulose appearance, ochrey yellow or flesh colour. The nodules produce long spines, which are covered by the hymenium producing the spores. It has been forwarded from Chelmsford by Mr. Fred. Chittenden, to the scientific committee of the Royal Horticultural Society, and seems to be the first record of its occurrence in Britain. There is a woodcut in Massee's *Plant Diseases* (fig. 39). According to Thuemen, this fungus is very frequently destructive to apple trees, and is presumably a wound fungus, the spores entering through a wound, or fissure of the bark, and soon becoming developed. An allied species, *Hydnum diversidens*, was found on beech in Epping Forest a few years ago.

From the same source, the flowers of *Clematis jackmanni* (?) were sent, infested with a white mould, which has been named *Ovularia clematidis* (Chitt.) forming whitish patches on the petals, from 2 to 4 centimetres in diameter. The conidia are elliptically cylindrical, with rounded ends $28-42 \times 14-16$ micromillimetres, and large for the genus.—M. C. COOKE, LL.D., A.L.S., September, 1903.

Gigantic Mushroom.—The *Daily Mail* is responsible for the following: "A pink-tinted mushroom over one foot in diameter and weighing 2lb. 10z. was picked by Mr. Death on Snails Hall Farm, Billericay, Essex, yesterday morning, August 25th." This was probably a specimen of *Agaricus arvensis*, the "Horse Mushroom," which often grows to a great size.

ANTHROPOLOGY.

The Relative Age of the Thames Valley Stone Implements.—At the meeting of the Essex Field Club on April 4th last, I exhibited a series of the various groups of implements,—Eoliths, "Hill Group," "Acheulian," "Mousterian" and "Rock Shelter,"—from various spots in the Thames Valley. Mr. Hinton and I have been studying the gravels of the Valley from a physical standpoint, and we have arrived at certain conclusions as to their age. I have ventured to apply the results of that work to the study of the stone implements found in these

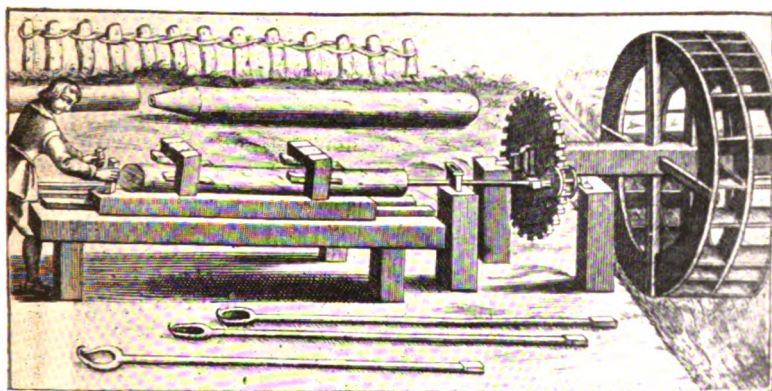
deposits. In my opinion the gravels show a complete succession in time. Starting with the Plateau gravels, in which were found the Eolithic implements, next come an intermediate stage yielding older Palæoliths (to this the late Professor Prestwich has applied the term "Hill-group"). Thirdly come the High Terrace gravels, in which occur the typical Palæoliths, called on the Continent "Acheulian." Fourthly come the Middle Terrace deposits, in which at Grays, Northfleet, and Crayford, implements occur that are in my opinion identical with those of the "Mousterian" or oldest Cave series. Later still come the Third Terrace, and the "disused channel," in which no special group of implements have been found, though elsewhere late Palæoliths called the "Rock-Shelter group" have been discovered which probably belonged to one of these. Since excavations in these lower beds are very rare it was of the utmost importance, when any fresh sections were opened, that they should be carefully examined, and all implements collected and preserved. It was these lower beds that would enable the present gap between Palæolithic and Neolithic implements to be bridged over. At the meeting of the Club I pointed out that a bed of gravel might yield not only the implements actually in use at the time of the deposition of the gravel, but also all the other older groups of implements which had been derived from pre-existing gravels. Thus the gravel in the present bed of the Thames yielded everything from Eoliths to the latest pattern in tea-cups.

—A. S. KENNARD, Beckenham, June, 1903.

A Modern Lake-Dweller.—The Zurich correspondent of the *Daily Express* telegraphs (August 28, 1903) that "Mr. Henneberg, a great silk manufacturer, who recently retired from business, has built for himself on Lake Constance, a habitation exactly after the model of a prehistoric lake dwelling shown in the Zurich Museum. The building, which is about 200ft. off the coast of the lake, rests upon piles, a few yards above the level of the water. It consists of only one room, and its framework is made from the wood of the yew tree. Round this room a gallery extends of a width of some 5ft. or 7ft. The walls consist of willow wicker-work and mud-plaster, the floor of hard mud and plaited willow, and the ceiling of pressed straw. The walls are ornamented with designs drawn with coal and bullock's blood."

Method of Boring Wooden Water-Pipes in the Seventeenth Century.—Mr. Eliot Howard has obligingly called attention to a passage in Evelyn's *Sylva*, describing the method of boring elm-trunks for water-pipes, and he has sent a copy of the book, so that the accompanying photographic reproduction of the original copper-plate engraving could be made. The extracts are from the 3rd edition (1679) of the book, Chap. xxx., page 195 :—¹

" . . . But I pursue these *Instances* no farther, concluding this *Chapter* with the *Norway Engine* or *Saw-Mill*, to be either *moved* with the force of *Water* or *Wind*, etc., for the more expedite cutting and converting of *Timber*, to which we will add another, for the more facile *perforation* and boring of *Elms*, or



other *Timber* to make *Pipes* and *Aquæducts*, and the excavating of column, to preserve their *shafts* from *splitting*, to which otherwise they are obnoxious. [Then follows a description and plate of the Norway Saw-Mill.] . . . The *second* figure for *Boring* consists of an *Ax-tree*, to which is fastened a *wheel* of *six* and *thirty* *teeth*, or more, as the velocity of the water-motion requires ; for if it be *slow* more teeth are requisite ; there must also be a *Pinion* of *six*, turn'd by the said indented *Wheel*. Then to the *ax-tree* of the *Pinion* is to be fixt a long *Auger*, as in the letter *A*,² which must pass through the hole *B*, to be opened and clos'd as occasion, somewhat like a *Turner's Lathe* ; the *Tree* or *piece* of *Timber* to be *Bored*, is to be placed on the Frame *C D*, so as the Frame may easily slide by the help of certain small *Wheels*, which are in the *hollow* of it, and turn upon strong *Pins*, so as the *Work man* shove forward, or draw the *Tree* back, after 'tis fastened to the *Frame* ; that so the *Auger* turning, the end of the *Tree* may

¹ *Sylva, Or a Discourse of Forest-Trees, and the Propagation of Timber in His Majesty's Dominions*. . . . Third Edition. By John Evelyn Esq., Fellow of the Royal Society. London. Printed for John Maistyn, Printer to the Royal Society, and are to be sold at the Bell in St. Paul's Churchyard. MDC.LXXIX.

² The lettering does not appear on the engraving.

be applied to it; still remembering to draw it back at every progress of three, or four inches, which the *Auger* makes for the cleansing of it from the *Chips*, lest the *Auger* break; continue this work till the *Tree* or *piece* of *Timber* be bored as far as you think convenient, and when you desire to enlarge the *hole*, change your *Auger Bits* as the *Figure* represents them."

GEOLOGY.

Old Accounts of Discoveries in the Alluvium of the Thames Valley.—In Pepys's *Diary* (Sept. 22nd, 1665) is the following :—

"At Blackwall. Here is observable what Johnson tells us, that in digging the late Docke, they did 12 feet under ground find perfect trees over-covered with earth. Nut trees, with the branches and the very nuts upon them; some of whose nuts he showed us. Their shells, black with age, and their kernell, upon opening, decayed, but their shell perfectly hard as ever. And a yew tree (upon which the very ivy was taken up whole about it) which upon cutting with an adde, we found to be rather harder than the living tree usually is."

In the *Times* of Dec. 7, 1902, the following paragraph is reprinted from the *Times* of Dec. 6, 1802 :—

"The Forest that has been discovered underground in the Isle of Dogs, is supposed to be the greatest natural curiosity in this Empire; perhaps in Europe. All that is called antiquity seems but yesterday compared with this wonderful ruin, of which there is no tradition whatsoever. Immense trees, with their bark uninjured, although their trunks are rotten, glass, charcoal, filbert shells, perfect human bones, etc., etc., are amongst the contents of this unsuspected subterranean.

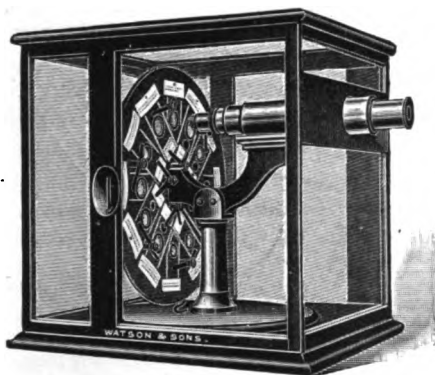
While Pepys's spelling is evidently a little more ancient than that of the *Times* of 1802, the treatment of the discovery in the latter suggests less experience of dock excavation, and consequently a greater antiquity than the account of 1665.—T.V.H.

MISCELLANEA.

"Anent a Forest Lodge in 1444" (E.N. xii., 145).—Since I had the pleasure of reporting on Mr. Hyett's interesting MS., I have come on an entry or two in the Patent Rolls which throw a probable light on his possession of it. In 17 Edward IV. (1478), on March 2nd, George Hiett had a grant for life of the office of Rider of the King's Forest of Dene, co. Gloucester, void by the death of Richard Hiet, his father, with the accustomed fees. This he surrendered in 1480; but in 1484 (2 Richard III.) he had a re-grant of the same office during

pleasure, with that of ale-conner within the parish of Newland, parcel of the office of rider.—W. C. WALLER, Loughton.

Museum Microscope.—By the courtesy of Messrs. Watson and Sons we are enabled to give an illustration of the special form of microscope constructed by them for the museum. It will be seen that the microscope is enclosed in a glass case to protect it from dust, the focussing being controlled by an external milled-head. The slides (12 in number) are arranged radially on a metal disk, the milled margin of which is accessible by means of slit-openings in the case, so that the disk can be revolved to bring each object into position in front of the objective. The instrument we have at present is provided with



an objective of about an inch focus. All curators have experienced a desire to exhibit specimens by means of the microscope, but the difficulty has been to prevent injury to the instruments and the objects; the museum microscope solves this difficulty. We hope in time to have several instruments, so that botanical, zoological, and petrological specimens, sections and other preparations, may be shown in series in the several departments of our museum.

Errata.—*Ante page 28*, the Family heading, PLEURONECTIDÆ, should be placed above *Hippoglossus*.—*Page 88, lines 5 and 6*, the stones from Grays, presented by Mr. Kennard, were *Neoliths*, not Eoliths.

THE OAK GALLS AND GALL INSECTS (CYNIPIDÆ) OF EPPING FOREST.

PART II. DESCRIPTIVE AND FAUNISTIC.

By E. J. LEWIS, F.L.S., F.E.S.

(Continued from Volume XII., page 286)

IN studying the Oak Galls of the Forest, reference must be made to the first part of this paper, which dealt with the structure and biological history of oak galls, with directions for collecting and breeding. On the subject of classification, Mr. Lewis observed, at the end of the former paper :—

“ Since the discovery by Dr. Adler of the alternating agamic and sexual generations among the oak gall-makers, the nomenclature has undergone a change. The method adopted by Mr. Cameron is the truly scientific one, but these alternating generations present such variations that the generic names used by Dr. Adler,¹ which serve to differentiate more clearly between the agamic and sexual forms, are still adhered to in many cases.”

A List is, therefore, inserted here, showing the differences between the nomenclature of these two authors ; and Mr. Lewis added :—

“ In the following account I have kept the generic name of the agamic generation for the sexual generation also. In this respect I have followed Cameron,² but in the case of the specific names I have, with a few exceptions, retained those used by Dr. Adler.

“ In the case of the three forms, *Andricus fecundatrix*, *Andricus malpighii*, and *Dryophanta divisa*, I have found galls of the agamic generation only, and have been unable to find specimens of the corresponding sexual generations, *Andricus pilosus*, *A. nudus* and *Dryophanta verrucosus* respectively ; so that in this List these latter have been printed in *italics*. I have inserted them partly because in giving an account of the generation cycle they must necessarily be mentioned, and partly on account of the fact that as I have found the agamic generation in Epping Forest, it is highly probable that the sexual generation is to be found there also, and a description will, therefore, be of use in distinguishing these galls.”

The publication of this second part of Mr. Lewis' paper has been delayed in the hope that *figures* of the galls might be included. The author's engagements have prevented this, but it is anticipated that figures may be given in a list of the oak galls of Britain, with indications of their occurrence in Essex, which is in contemplation. Meanwhile, we may point out that some of

¹ *Alternating Generations. A Biological Study of the Oak Galls and Gall Flies.* By Hermann Alder, M.D., Schleswig. Translated and Edited by Charles R. Straton, F.R.C.S., F.E.S. Oxford 1894.

² Peter Cameron's *Monograph of British Phytophagous Hymenoptera*, vol. iv. London Ray Society, 1882-92.

the galls were figured in Mr. Fitch's paper, in the second volume of our *Transactions*,³ and that coloured figures are given in Dr. Adler's and Mr. Cameron's books, to which attention has been directed.—ED.

ORDER HYMENOPTERA.

Family CYNIPIDAE.

Sub-Family CYNIPINA.

Genus *NEUROTERUS* (Htg.).

This genus contains, besides several from America, eleven European species. In the sexual form the perfect insect has the ovipositor short and nearly straight, the eggs being laid in the leaf; the agamic forms have the ovipositor longer and more spiral, as the eggs in this case are laid in the buds. The agamic form also has the abdomen larger, but more compressed than in the sexual form. *Neuroterus punctatus* and *Neuroterus politus* are the only two British species already known that do not make galls; the former has been taken from oak buds, but without distorting them in any way. The agamic forms all make flat spangle galls on the backs of oak leaves, with the exception of *N. aprilinus*; the galls of the sexual generation differ in position and appearance, the eggs being always laid in the bud and not on the leaf.

General colour black. There is no suture between the mesonotum and the scutellum.

Sexual forms have the legs light yellow.

Agamic forms have the legs darker.

(1.) Agamic Generation I. *Neuroterus lenticularis* (Ol.)

Inquiline. *Synergus tscheki* (Mayr.)

Gall.

Appears on the under surface of the oak leaf (diameter 4-6 mm.) *Colour*: Yellowish-red. Under-surface flat, white and glabrous. *Shape*: Rounded, conical in the centre. Numerous on the leaf.

Imago.

Colour: Black. *Antennae*: Brownish, 15-jointed, 2-3 basal joints yellow. *Thorax*: Rough and finely punctured. *Mesonotum*: Shagreened. *Abdomen*: Compressed and shining. *Ovipositor*: Curved and longer than the abdomen. *Legs*: Yellowish; bases of femora and coxæ darker. *Wings*: Hyaline; first cubital cellule slightly clouded.

³ "The Galls of Essex," *Trans. E.F.C.* II. pp. 98-156.

(1.) Sexual Generation. IA. *Neuroterus baccharum* (Linn.) Inquilines. *Synergus facialis* (Htg.) *S. radiatus* (Mayr.) *S. albipes* (Htg.)

Gall.

Grows through the leaf or appears on the ♂ catkin. *Colour*: Yellowish green, green and red or entirely red. *Shape*: Globular. Soft and sappy. (Diameter 3-5 mm.)

Imago.

Colour: Black. *Antennæ*: Brownish, 2-5 basal joints yellow; in the ♂ 15-jointed, in the ♀ 14-jointed. *Thorax*: Dull and rough; scutellum wrinkled. *Abdomen*: Distinctly pedunculate. *Ovipositor*: Short. *Legs*: Yellow, coxae entirely black or only at the base. *Wings*: Hyaline, broader towards the apex, longer than the body; first cubital cellule clouded.

Account of Generation Cycle.

The *Neuroterus lenticularis* galls fall to the ground in September and October, dampness being necessary to enable them to reach maturity. They may be found in the winter in a swollen condition, either separated from, or still adhering to, the leaf.

The insects emerge from these galls in April and sometimes in May. This is the asexual brood, comprising females only, and these immediately proceed to lay their eggs in the oak buds. The resulting galls, *N. baccharum*, appear in May or the beginning of June, the insects emerging from them at about the middle of the month. The reason for this rapid maturity is to be found in the soft and sappy condition of the galls, which are liable soon to dry up. This being the sexual generation, oviposition takes place only after copulation, and the eggs are laid in the backs of the leaves at about the end of June. In three weeks galls appear on the under-surface of the leaves. These are *N. lenticularis* galls.

Unless parasitised, the *N. baccharum* galls shrivel up soon after the insects have emerged; these insects only lay their eggs on the young and tender leaves.

OCCURRENCE IN EPPING FOREST.

I found *Neuroterus lenticularis* galls very common. First appearance noted, July 19th. *Neuroterus baccharum*. Abundant. Leaf and catkin galls both plentiful. In many cases I found two or three galls amalgamated. First appearance noted May 10th.

(2.) Agamic Generation. II. *Neuroterus læviusculus* (Schenck). Inquilines. *Synergus tscheki* (Mayr.)

Gall.

Appears on the under-surface of the oak leaf (diameter 2.3 mm.) *Colour*: Yellowish to reddish. *Shape*: Irregular to circular, cup-shaped and pointed in the centre; few or no hairs present. Numerous on the leaf.

Imago.

Colour: Black. *Thorax and Head*: Smooth and shining. *Abdomen*: Compressed and elongate. *Antennæ*: Dark brown, 2 basal joints may be yellowish. *Legs*: Dark brown. Apices of all the joints yellow. *Wings*: Hyaline.

(2.) Sexual Generation IIA. *Neuroterus albipes* (Schenck). Inquiline. *Synergus apicalis* (Htg.)

Gall.

Appears on the margins of the leaves, causing indentations, and in some cases stunting them. *Shape*: Oval, may be somewhat pointed at the apex. Sessile on the leaf margin, *Colour*: Yellow to yellowish green.

Imago.

Colour: Black. *Antennæ*: Brownish. Basal 4-5 joints yellow. Third joint slightly curved in the male. *Thorax*: Smooth and shining. *Abdomen*: Shining and compressed. *Ovipositor*: Testaceous. *Legs*: Usually very light yellow in colour. *Coxæ* and bases of femora dark. *Wings*: Hyaline, nervures pale.

Account of Generation Cycle.

The *Neuroterus laevisculus* galls fall to the ground, like *N. lenticularis*, in the Autumn. Moisture is also necessary for them if they are to reach maturity.

Asexual flies emerge from them as a rule about the end of March. These insects prick the oak buds at the end of March or the beginning of April; the resulting galls, *N. albipes*, which are small and hard, appear in May.

From the galls of *N. albipes*, sexual flies emerge at the end of May, though often not until June. These flies oviposit on the under-surface of the young and tender leaves, and in about three weeks the galls of *Neuroterus laevisculus* again appear.

OCCURRENCE IN EPPING FOREST.

The *Neuroterus laevisculus* gall often has the edges curled over, and may be very irregular in shape, in many cases bearing a great resemblance to *Neuroterus fumipennis*. First appearance noted August 12th. This gall was not so common as the preceding. *Neuroterus albipes*, however, was very abundant, the first appearance I noted being on May 18th. This gall I found in a variety of situations, both on the petioles and on the leaves themselves, causing them to become indented and to curl up.

(3.) Agamic Generation. III. *Neuroterus numismatis* (Ol.). Inquiline, *Synergus tscheki* (Mayr.)

Gall.

Appears on the back of the oak leaf, numbers being found on one leaf. Commonly known as the "button gall." (Diameter 2 mm). *Colour* : Brown. *Shape* : Round, resembling buttons made of a light brownish silk with a more or less deep depression in the centre.

Imago.

Colour : Black. *Antennae* : Brownish black, may be a little lighter in colour at the base. *Thorax* : Dull. Mesonotum shining. *Legs* : Variable. Usually brownish yellow in colour. *Wings* : Hyaline.

(3.) Sexual Generation. IIIa. *Neuroterus vesicatrix* (Schltal).

Gall.

Appears imbedded in the leaf substance. (Diameter 2-3 mm). *Colour* : Greenish. *Shape* : Circular, slightly bulging the leaf surface. Centre somewhat raised, with rays running from it to the margin.

Imago.

Colour : Black. *Antennae* : Brownish 2-3 basal joints yellow. *Thorax* : Mesonotum and scutellum smooth and shining. Parapsidal furrows usually wanting. *Legs* : Yellow. Coxae and bases of femora dark. *Wings* : Hyaline. End of 1st cubital cellule slightly clouded.

Account of Generation Cycle.

When the galls of *N. numismatis* drop to the ground, development continues in the dampness thus afforded. The insects emerge from them about the end of March. The individuals of this, the agamic generation, proceed at once to oviposit in the buds, the resulting gall, *N. vesicatrix*, appearing in the leaf in May. From these galls the sexual generation of insects appears in June, the eggs being laid on the under-surface of the tender leaves. In three or four weeks the galls of *N. numismatis* appear.

OCCURRENCE IN EPPING FOREST.

Neuroterus numismatis was exceedingly plentiful, quite as much so as *N. lenticularis*, the backs of the leaves often being entirely covered. First appearance noted August 12th. *Neuroterus vesicatrix* was not so common, the first specimen I met with

being on June 4th, though doubtless it appeared at an earlier date.

(4.) Agamic Generation. IV. *Neuroterus fumipennis* (Htg.). Inquiline. *Synergus tscheki* (Mayr.)

Gall.

Appears on the under-surface of the leaf. Numbers are found on one leaf, but usually they are not so numerous as in the preceding case (diameter 2-3 mm.). *Colour*: Pale reddish covered with a very delicate pubescence. *Shape*: Circular or, nearly so, with edges more or less curved upwards, and often emarginate.

Imago.

Colour: Black. *Antennae*: Brownish, 2-3 basal joints yellow. *Thorax*: Dull black, scutellum strongly shagreened. *Abdomen*: At base orange. *Legs*: Orange. *Coxae* brownish. *Wings*: Hyaline. 1st cubital cellule clouded.

(4.) Sexual Generation. IVa. *Neuroterus tricolor* (Htg.) Inquilines. *Synergus albipes* (Htg.) *S. facialis* (Htg.) *S. thaumacera*. (Dalm.)

Gall.

This appears on the leaf and sometimes on the stem. There may be one gall only, but usually more. Two or three may be amalgamated, and the leaves are usually more or less distorted. *Colour*: White or reddish, covered with a fair number of stiff upright pinkish or white hairs. *Shape*: Round, with the top sometimes slightly flattened. *Texture*: Soft and succulent.

Imago.

Colour: Black. *Antennae*: Dark, with basal joints paler. *Thorax*: Slightly shining, scutellum rugose. *Abdomen*: Dark brown, broadly reddish at the base. *Legs*: Yellowish red. *Wings*: Clouded, especially at the apices.

Account of Generation Cycle.

The *Neuroterus fumipennis* galls fall to the ground in autumn, but the larvæ remain as such throughout the winter, and in March they will be found to be in the same state as in the preceding autumn, when the galls dropped to the earth. They pupate at the end of April, and the perfect insects emerge in May. The eggs are laid in the swelling buds, giving rise to *Neuroterus tricolor* galls in June. These galls mature in July, yielding up the insects at about the middle of the month. As in all the preceding species, the sexual generation oviposits in the

backs of the tender leaves, causing the *Neuroterus fumipennis* galls to make their appearance in August or at the end of July.

OCCURRENCE IN EPPING FOREST.

Neuroterus fumipennis was very abundant. I have occasionally found this gall, together with *Neuroterus lenticularis*, *laeviusculus*, and *numismatis*, *Andricus ostreus* and *Trigonaspis renum*, all on the back of the same leaf. First appearance noted July 29th. *Neuroterus tricolor* was much less plentiful, and I only obtained a few specimens. These galls when old often shed their hairs and assume a brown dried-up appearance, exactly similar to an old form of *N. baccarum*. The hairs, however, may remain on the gall after it has dried up. I found this gall on May 30th.

(5). V. *Neuroterus schlechtendali* (Mayr.) Gall.

Appears on the catkin of the Oak in May forming a swelling in the connective or upper part of the filament of the stamen on each side of which are the anther lobes. This swelling is smooth, greenish-white in colour, with sometimes a tinge of pink, becoming brown with age. The anther lobes are thrust up by the swollen connective, forming what look like two flattened keels extending on each side of the gall from just below the middle to the apex.

The galls appear in May, but the life history of the insect has not been fully worked out, as the gall is uncommon; the perfect insects, however, emerge in July of the second year.⁴

Imago.

I have not succeeded in breeding any perfect insects from these galls,

This species is said by some authors to be the agamic form of *Neuroterus aprilius*, but the generation cycle has not yet been fully determined. I have been unable to breed any flies from the galls that I obtained in the spring, and if they appear in July it seems probable that this may be a sexual, and not an agamic form.

OCCURRENCE IN EPPING FOREST.

I found *Neuroterus schlechtendali* galls on two trees only, a number of galls being present on each catkin. They appeared

⁴Alternating Generations. Adler and Straton.

ST.

g Generations, and by Mr. P. CAMERON

URE OF MR. CAMERON.

NO. ATION.	SEXUAL GENERATION.
1. Chris, Ol.	Neuroterus lenticularis, Ol.
2. ulis, Schnk.	Neuroterus laeviusculus, Schuk.
3. atis, Ol.	Neuroterus numismatis, Ol.
4. nis, Htg.	Neuroterus fumipennis, Htg.
5. endali, Mayr.	Neuroterus aprilinus, Gir.
6.	
7. inn.	Dryophanta folii, Linn.
8. entris, Htg.	Dryophanta longiventris, Htg.
9. Htg.	<i>Dryophanta divisa</i> , Htg.
10. Htg.	
11. Htg.	Andricus sieboldii, Htg.
12. Htg.	Andricus corticis, Htg.
13. ab.	Andricus radicis (trilineatus), Fab.
14. Htg.	Andricus globuli, Htg.
15. Htg.	Andricus collaris, Htg.
16. Adler.	Andricus cirratus, Adler.
17. x, Htg.	<i>Andricus fecundatrix</i> , Htg.
18. Adler.	<i>Andricus malpighii</i> , Adler.
19. nn.	Andricus ramuli, Linn.
20. Htg.	
21. Fonsc.	
22. is, Gir.	
23. atus, Htg.	
24. ata, Schtdl.	
25. Fab.	Biorhiza terminalis, Fab.
26. era, Htg.	Trigonaspis megaptera, Htg.
27.	

Forest. See p. 138 of text.

rodzei (Htg.), and *Trigonaspis megaptera* (Htg.)
 one used by Dr. Adler.

about May 20th. I also found some fresh specimens on May 25th, but this species was not plentiful. I have met with it at Lynton, Devonshire.

(6).—Sexual generation. VI. *Neuroteus aprilius* (Gir.)
Gall.

Appears from the bud. Smooth and often polythalamous.

Colour: Greenish yellow. *Shape*: Circular to pear-shaped, the apex being usually narrower than the base which is embedded in the bud scales. Larval cavity large, walls very thin.

Imago.

I have, unfortunately, been unable to breed flies from these galls, as in all the specimens which I found the perfect insects had already emerged.

The galls appear in April, and the insects towards the end of the month or the beginning of May. They may be situated in either the terminal or auxiliary buds, and yield up the perfect insect very soon after they make their appearance from the buds. With regard to the agamic generation of this species some uncertainty seems still to exist. Beyerinch gives *A. solitarius* as the agamic form, but this is probably a mistake. Von Schlechtendal and Dr. Loew give *Neuroterus schlechtendali* (Mayr), and Cameron also inclines to this view, but at the same time, in his description of the perfect insect, he describes it as sexual. Dr. Adler mentions *Neuroterus ostreus* as the probable agamic form, and Professor Mayr seems to have since verified this, but the insect belongs to the genus *Andricus*, and not to the genus *Neuroterus*.

OCCURRENCE IN EPPING FOREST.

I found a fair number of specimens of this gall, though it was not plentiful. The first appearance I noted was on May 10th, at which time the perfect insect had already emerged.

These galls become brown with age.

Genus DRYOPHANTA (*Foerster*).

The agamic forms of this genus are usually easily separated, but the sexual forms present very similar characters, and it is impossible to differentiate between the species. The two generations, Agamic and Sexual, are readily distinguished. The former have the legs covered with stiff hairs, which are absent in the

sexual forms. The agamic forms also have hairs on the antennæ, and the ventral spine is thickly haired. There is no sculpture on the mesothorax of the sexual generation. The chief difference is in the ovipositor, which in the agamic forms is long, slightly curved, and straight at the point, while the sexual generation has the ovipositor short and somewhat hooked at the end. This difference is due to the fact that in the former case the eggs are laid in the bud, and in the latter they are laid in the leaf. As pointed out by Dr. Adler, the study of the ovipositors of the gall-making Cynipidæ is very important, as some forms, such as the sexual forms of the *Dryophanta* group and the corresponding forms of the genus *Neuroterus*, are almost identical, except for the differences existing between the ovipositors.

SYNOPSIS OF GALLS OF THE AGAMIC GENERATIONS OF THE GENUS DRYOPHANTA.

In this genus, the galls giving rise to the agamic generation are very similar in character, all being circular and found on the veins at the back of the leaf.

- | | | | |
|--------|--|----|---------------------------|
| 1. (6) | Hard and woody. | | |
| 2. (5) | Larval cavity small, walls thick.. | .. | .. <i>D. longiventris</i> |
| 3. (4) | Top depressed with an elongated elevation in the
centre of the depression | .. | .. <i>D. disticha</i> |
| 4. (3) | Top depressed with no elongated elevation in the
centre of the depression | .. | .. <i>D. divisa</i> |
| 5. (2) | Larval cavity large, walls thin | .. | .. <i>D. agama</i> |
| 6. (1) | Soft and spongy | .. | .. <i>D. folii</i> |

I was unable to find any specimens of *D. disticha* in Epping Forest.

(7). Agamic Generation. I. *Dryophanta folii* (Linn).

Inquilines. *Synergus pallicornis* (Htg.), *S. tscheki* (Mayr) and *S. vulgaris* (Htg.)

Gall.

Appears on the under-surface of the leaf, arising from the leaf vein with which it is connected by a small point. Two or three may be found on one leaf. *Colour* : Green when young becoming yellowish, the exposed side of the gall is often red. *Shape* : Globular. This gall, which varies much in size and is

the largest of the group, is soft and spongy, and dries up with age when the surface becomes wrinkled and irregular.

Imago.

Colour : Black. *Antennae* : Brownish black, furnished with long hairs ; thirteen jointed, twelfth joint as long as broad. *Thorax* : Scutellum, mesonotum and part of the pleurae may be reddish brown. *Abdomen* : Black and shining. *Legs* : Black. Femora and upper parts of tibiae, reddish brown. *Wings* : Hyaline, long ; cubitus, and radial cellule at base, dark.

(7). Sexual Generation. 1A. *Dryophanta taschenbergi* (Schltdl).

Gall.

Length 2-3 mm. Appears usually from the adventitious buds on the trunk of the tree or from buds on young shoots which have grown from these adventitious buds. *Shape* : Oval, apex rounded. Purple in colour and velvety in appearance; there is an inner gall which is soft and starchy.

Imago.

Colour : Black, shining. *Antennae* : Black. *Thorax* : Black, smooth and shining ; scutellum dull. *Abdomen* : Black. *Legs* : Yellowish, trochanters black, femora infuscated. *Wings* ; Hyaline, long and smoky.

Account of Generation Cycle.

Although the perfect insect begins to gnaw its way out of the *Dryophanta folii* gall in November, it does not usually emerge until the following March, the exact time of its appearance varying according to the temperature.

The eggs are then laid in the adventitious buds on the trunk of the oak tree, one egg in each bud at the base of the bud axis (sometimes also in the buds of twigs). The resulting gall *D. taschenbergi*, appears at the end of April and during May, maturing at the end of the latter month. The flies emerge from these galls at about the beginning of June, the females ovipositing in the veins of the softer leaves always at the back of the leaf.

Dryophanta folii galls appear early in July and mature in October, usually falling to the ground when this stage is reached.

OCCURRENCE IN EPPING FOREST.

Dryophanta folii. Very abundant. When young the gall is covered with minute nodules lighter in colour than the rest of the gall, which subsequently disappear when the gall reaches maturity. In some instances I have found as many as five of these galls on one leaf, completely weighing it down. First appearance noted, July 19th.

Dryophanta taschenbergi. Very plentiful, especially growing from adventitious buds on the trunks of old trees. I have also found some of the galls on the buds of twigs, growing quite at the base of the trunk. When old, these galls lose their velvety purple appearance and assume a dull brown colour, often remaining on the trees for a considerable time after the insects have emerged. First appearance noted, May 18th.

(8). Agamic Generation. II. *Dryophanta longiventris*. (Htg.) Inquilines. *Synergus pallicornis* (Htg.) and *S. apicalis* (Htg.)

Gall.

Found on the under-surface of the leaf arising from the leaf veins. *Shape*: Globular, the surface often being nodulated and sometimes wrinkled. *Colour*: Green to yellowish white, often marked with reddish stripes.

This gall is hard and woody, the central cavity is small and the walls are thick. The top is not depressed. It is much smaller and more flattened than *D. folii*.

Imago.

Very similar to *Drophanta folii*, the only tangible difference being in the antennæ, which have the 12th joint less broad than long. There are no other constant characters by which these two insects can be differentiated.

(8.) Sexual Generation. II.A. *Dryophanta similis*. (Adler).

Gall.

Very similar to *D. taschenbergi*, but more slender and pointed. It is covered with hairs, which are longer and whiter than is the case with the *D. taschenbergi* gall, which give the original green colour a somewhat greyish appearance. I have found these galls slightly purple in colour.

Imago.

Almost identical with *D. taschenbergi*, though generally somewhat darker in colour.

Account of Generation Cycle.

The *Dryophanta longiventris* gall is very liable to parasitic infestation. The perfect insects mature in November and December, when they sometimes emerge, but usually they do not appear until March. The date at which they leave the gall depends a great deal upon the temperature. They lay their

eggs in the adventitious buds near the base of the tree. *Dryophanta similis* galls are formed at the end of April or the beginning of May; from these the flies emerge usually about the middle of the month, earlier as a rule than *D. taschenbergi*.

This sexual generation oviposits on the undersurface of the oak leaf, the resulting gall, *D. longiventris*, appearing at the end of July or beginning of August.

OCCURRENCE IN EPPING FOREST.

Dryophanta longiventris. Very plentiful, but less so than *D. folii*. When these galls are kept in a room the flies may emerge in October, and I have taken mature flies from the galls in September. First appearance noted July 19th. I met with only a few specimens of *Dryophanta similis*, mostly on twigs growing adventitiously from the trunks of the trees, especially near the base. First appearance noted May 10th.

(9).—Agamic Generation. III. *Dryophanta divisa* (Htg.) Inquilines. *Synergus pallicornis* (Htg.), *S. tscheiki* (Mayr), and *S. albipes* (Htg.)

Gall.

The galls in this instance are more numerous on the leaf than is the case with the corresponding generations of preceding species of this genus. They are found on the under-surface of the leaves. *Shape*: Roundish, with a depression at the top. The larval cavity is small and the walls are thick. It is hardy and woody. *Colour*: Red when young, becoming brown with age.

Imago.

Colour: Brown, may be slightly reddish. *Antennae*: Black. *Thorax*: Mesonotum pubescent, with two black stripes, punctured anteriorly. Sutures black. *Abdomen*: Black. *Legs*: Brown with base of coxae infuscated; trochanters, and more or less of the tarsi, black.

(9).—Sexual Generation. IIIA. *Dryophanta verrucosus* (Schltdl).

Gall.

I have not found this gall in Epping Forest. Elongated with rounded extremities, it may appear on the leaves or buds. *Colour*: Varies from green and greenish yellow to red.

The gall secretes a fluid in its vesicles, which covers it as a protection against parasites, giving it a glossy appearance.

Imago.

Identical with preceding sexual forms.

Account of Generation Cycle.

The perfect insects emerge from the *Dryophanta divisa* galls, and at once proceed to prick the buds. This happens in October, near the end of the month, and at the beginning of November. In the following May the galls of *Dryophanta verrucosus* appear. They may develop on the leaf or from the bud direct. From these galls the perfect insects of the sexual generation emerge at the end of May, and lay their eggs in the tenderest leaves, *Dryophanta divisa* galls appearing at the end of July.

OCCURRENCE IN EPPING FOREST.

Dryophanta divisa. Not plentiful, though I found them in some cases in numbers on the leaf. First appearance noted, July 19th.

I was unable to obtain any specimens of *Dryophanta verrucosus*.

(10.) Agamic Generation. IV. *Dryophanta agama* (Htg.) Inquilines. *Synergus pallicornis* and *S. albipes* (Htg.) Gall.

Shape: Circular. Found on the under-surface of the leaves emanating from the leaf veins. Central hollow large; walls thin. *Colour*: Pale yellow, but many have a pale pink or reddish tint, becoming browner with age.

Imago.

Colour: black. *Antennae*: 12th antennal joint longer than broad; a variable number of basal joints may be reddish. *Thorax*: More glabrous than in preceding species. *Abdomen*: Black. *Legs*: Yellowish red, base of coxae usually darker in colour.

There is no known sexual form, though it is probable that another generation exists.

The galls are found towards the end of July and in August on the veins at the back of the oak leaves. They can be easily distinguished from *D. divisa* by their smaller size, rounder shape, and larger larval cavity. The flies emerge in November.

OCCURRENCE IN EPPING FOREST.

This gall was not abundant but more frequently met with than *Dryophanta divisa*. First appearance noted, August 10th.

Genus ANDRICUS (Hartig).

So far as we know at present, the genus *Andricus* includes a greater number of oak gall-making species than any other of our genera. I have kept the generic named *Andricus* for both generations. Adler gives *Aphilotrix* as the generic name of the agamic generation. Some species have no sexual generation (*A. seminationis* (Gir.), *A. quadrilineatus* (Htg), etc.); these have only one generation a year.

The agamic forms of this genus have the antennae as a rule 14-jointed, 13 antennae joints being the exception. The colour varies, a few species being quite black.

The sexual forms differ from the agamic in having the antennae as a rule 13-jointed. *Andricus curvator* (Htg), however, has 14-jointed antennae. The colour is not so variable, the majority of species being quite black.

I have found that in some cases the agamic forms of this genus are apparently much more common than the corresponding sexual generation. This is especially the case with such species as *A. callidoma* (Htg.) and *A. fecundatrix* (Htg.) *A. callidoma* is fairly common in Epping Forest, but I have only once found *A. cirratus* (Adler). *A. fecundatrix* again is exceedingly common, but I have not been able to find a single specimen of *A. pilosus* (Adler), in spite of repeated search. I have also obtained several specimens of *A. malpighii* (Adler), but have not met with *A. nudus*. This might be due to the fact that these catkin galls are easily passed over unnoticed; but I do not think that this is entirely the reason, as I thoroughly examined the catkins on a great number of trees without success. During two days' collecting in the neighbourhood of Lynton, North Devon, I found all three species to be very common at the beginning of June, 1900.

(11.) Agamic Generation I. ***Andricus sieboldii* (Htg.)**

Inquiline. *Synergus incrassatus* (Htg.)

Gall.

Appear through the bark of the stems of the oak, usually near the base not far from the ground. They are found as a rule on small oaks in hedges, and on old pollard oaks. The galls penetrate deeply into the wood, stunting the growth, and sometimes killing the younger plants. *Colour*, Cherry red when young,

becoming purple when older, due to a rind which covers the galls. This peels off later, leaving the gall beneath brown and striated. *Shape* : That part of the gall visible through the split bark is conical in shape. The larval chamber is in the lower, deeply imbedded part, which is dilated.

Imago.

Colour : reddish-brown. *Antennae* : dark brown, paler at the base. *Thorax* : median segment and basal scutellar sutures dark. *Abdomen* : reddish brown, 3rd segment finely punctured. *Legs* : reddish brown.

(11.) Sexual Generation. 1A. *Andricus testaceipes* (Htg.)

Inquiline. *Synergus apicalis* (Htg.)

Gall.

A thickening of the leaf stalk or vein of the leaf contains the gall lying within in a hollow chamber. I have found two specimens in the shoot, which I at first mistook for *A. trilineatus* (Htg.) galls. *Colour* : Yellowish green.

Imago.

Colour : black. *Antennae* : Dark. Basal joints paler. *Thorax* : May be slightly hairy at the base of mesonotum. *Abdomen* : orange, darker above. *Legs* : orange yellow, the base of hind coxae brownish.

Account of Generation Cycle.

If the galls of *A. sieboldii*, when mature, are kept through the winter, the insects emerge in April or May. The buds are pricked by them near the base, as in *A. radialis* (Fab). The resulting gall in some cases resembles *A. trilineatus*, but the eggs are deposited in the rudimentary leaves, the gall appearing usually in the veins and petiole of the leaf. The flies from this gall emerge in August. Oviposition takes place through the bark of young stems near the ground, the eggs being laid as a rule in a ring. The bark begins to swell in the autumn, but ceases to do so during the winter. During May in the following spring the red conical galls appear, the reddish rind covering the galls breaks off, and they mature in June, but the flies do not emerge till the following April or May.

OCCURRENCE IN EPPING FOREST.

Andricus sieboldii. Uncommon. I only met with a few specimens of this gall growing from the stems of some old pollard oaks. The galls, which were situated near the bases of the stems, were old and dried up.

Andricus testaceipes. Not plentiful. I found galls both on the petiole and mid-rib of the leaf.

First appearance noted, June 15th.

(12.) Agamic Generation. II. *Andricus corticis* (Linn.)
Inquiline. *Synergus incrassatus* (Htg.).

Gall.

Found on the oak trees in places where the bark has been injured, as when a branch has been sawn off or broken by wind. The gall is covered over in a thin sappy yellowish rind, which afterwards falls off and leaves the gall exposed. The larval chamber is sunk deep in the wood, the upper half, which projects, being shed at maturity. The punctured rims then plainly mark the presence of the galls.

Imago.

Colour: Brownish black. *Antennae*: Dark brown, base reddish. *Thorax*: May be slightly hairy, dark brown and smooth. *Abdomen*: Lighter in colour than the thorax. *Legs*: Reddish brown.

(12.) Sexual Generation. IIa. *Andricus gemmatus* (Adler).

Gall.

Small, only 2 mm. in length. Appears in the leaf axil or growing from axillary buds. The apex of the gall only may appear. I have found this gall on the leaf as well as in the bud, when the shape is oval, the rind smooth and thin, and the apex may be narrower. Green to brown in colour, though I have sometimes found it quite red. Often it is very similar in appearance to *N. albipes*. I have also found it attached to the petiole of the leaf.

Imago.

Colour: Black, shining. *Antennae*: Brownish black, base paler. *Thorax*: Dull black. *Abdomen*: Dark, with brownish red ventral surface. *Legs*: Yellowish red. Base of femora dark, but much lighter in colour in the male.

Account of Generation Cycle.

The flies emerge from the *A. corticis* galls in April and May, and lay their eggs deep in the bud. The resulting gall, *A. gemmatus*, appears in June, and the insects emerge in July or August. I have never seen the insects of the sexual generation engaged in ovipositing. This takes place in injured parts of the

bark of stems or trunk. I have found the insects during early spring in a mature condition in the galls.

OCCURRENCE IN FPPING FOREST.

Andricus corticis. Very common, especially in the callus formed by the exposed cambium where the bark of old trees has split down. On account of their brown covering, these galls are easily passed over, but after the insects have emerged they present a very typical appearance, having a punctured rim showing where the vascular bundles have passed through to nourish the upper part of the gall.

I have taken mature flies from these galls in February.

Andricus gemmatus. Common. First appearance noted, June 20th.

I have sometimes found these galls on the leaf petiole.

(13.) Agamic Generation. III. *Andricus radialis* (Fab.)
Inquiline. *Synergus incrassatus* (Htg.)
Gall.

Appears on the root of the oak, sometimes on the trunk of the tree partly above ground. Galls which appear on the roots may also be often exposed. *Colour*: White and soft at first, varying with increasing age from yellowish pink to bright red, becoming brown and woody later.

Shape and size differ considerably; four or five galls often appear in one mass, though each gall can easily be separated. In some cases the galls greatly resemble potatoes, but usually they present a cracked and wrinkled appearance. Larval cells numerous.

Imago

Colour: Reddish brown. *Abdomen*: Red. *Antennae*: Colour varies. Basal 4-5 joints brownish red; apex darker. *Thorax* and *head*: Pubescent. Mesonotum with a large central and two lateral dark lines. A dark transverse line in front of the scutellum. Metathorax dark. *Abdomen* may have a dark blotch on the first segment. *Legs*: Reddish, base of coxae black, tibiae and claws infuscated. *Wings* Hyaline, a few hairs sometimes present.

(13.) Sexual Generation. IIIA. *Andricus trilineatus* (Htg.)

Inquilines. *Synergus apicalis*, *S. vulgaris* (Htg.), *Ceroptres arator* (Htg.)

Gall.

Found in shoots of one year's growth, giving in some cases an uneven appearance; in others their presence is only noticeable after the insects have emerged by the small round holes in the shoots.

Imago.

Very variable. *Colour*: Brownish-red. *Antennae*: Dark. *Legs*: Testaceous, hind coxae dark. *Wings*: Hyaline. *Thorax* and *Head* marked with, or almost entirely, black. *Abdomen*: Dark. The male differs from above in being more shining and having the legs of a dusky orange colour, the coxae, hind tibiae and femora darker. *Head, thorax, and abdomen* usually quite black.

Account of Generation Cycle.

The asexual flies emerge from the *A. radialis* galls usually in April or May; and after resting, deposit their eggs in the base of the buds, the resulting galls appearing in the twig. Sometimes I have found the flies ovipositing as late as the middle of June, when the bud has partially developed. In either case the galls formed are *A. trilineatus*. When oviposition takes place as late as June, the galls are easily recognisable, as the eggs are crowded into one shoot, causing it to swell considerably. The sexual flies emerge from these galls, and oviposit in the roots in August, many eggs being laid together. The gall (*A. radialis*) breaks through the swollen root in September, but in October gall growth ceases until the following spring. The flies then mature in autumn, and emerge in the spring of the year following, usually in April or May.

OCCURRENCE IN EPPING FOREST.

Andricus radialis. Abundant. I found these galls either singly or 5 or 6 together; in the latter case they appear to form one gall on the root, but on removal they fall apart. They may appear quite above ground, be partially covered with earth or be entirely beneath the soil. They do not always appear on the root, but may grow direct from the trunk, either just above or below the ground. I have sometimes found these galls on the roots of young oak plants grown scarcely a foot high. The insects from the *A. trilineatus* galls seem to prefer ovipositing at some place on the root where an *A. radialis* gall has previously grown, so that old dried-up and woody galls of *A. radialis* may often be found near the fresh specimens.

Andricus trilineatus. Common. These galls are usually very difficult to see until the insects have emerged. They may, however, form swellings, especially when they occur on the leaf stalk.

First appearance noted, June 11th.

(14.) Agamic Generation. IV. *Andricus globuli* (Htg.)
Inquilines. *S. nervosus* (Htg.), *S. vulgaris* (Htg.), and *S. ruficornis*
(Htg.)
Gall.

Found in the bud in September, surrounded at the base with bud scales. Falls to the ground in October. *Colour*: Green, often having some lighter spots upon it. *Shape*: Globular. There is an inner gall with a large larval cavity, which is covered with an outer green rind. This rind falls off at maturity, leaving the woody inner gall exposed. This inner gall is furrowed.

Imago.

Colour: Black. *Antennae*: Brownish. *Thorax*: Dull, may be pubescent; mesonotum slightly punctured. *Abdomen*: Shining, ventral surface reddish brown, darker above. *Legs*: Reddish brown; coxae and four posterior tibiae infuscated. Stiff erect hairs on the fore tibiae.

(14.) Sexual Generation. IVA. *Andricus inflator* (Htg.)
Inquiline. *Sapholytus connatus* (Htg.)
Gall.

Resembles a thickened shoot. *Colour*: Light yellowish green with a red apex when young, becoming brown and woody later. The inner gall enclosing the larvæ is yellowish brown, smooth and oval, situated near the base of the cavity of the gall.

Imago.

Colour: Black. *Antennae*: Dark, reddish yellow towards the base. *Thorax* and *Head*: Black, slightly shining mesonotum shagreened. *Abdomen*: Reddish beneath, dark above. The male, according to Adler, has the abdomen entirely dark. *Legs*: Reddish brown, posterior tibiae and coxae dark.

Account of Generation Cycle.

The flies from the *A. globuli* galls emerge at the end of March or during April. When ovipositing the insect directs its ovipositor under the bud scales, the eggs being placed in the bud axis, one egg in each bud.

The *A. inflator* galls appear in May, giving rise to the sexual generation in July.

After fecundation, the females of this generation oviposit in the axillary or terminal buds, laying one egg in each bud; from these the *A. globuli* galls develop in September. The larvæ are full grown in October when the gall falls to the ground, and pupate in the following autumn, emerging from the gall in April of the second year.

OCCURRENCE IN EPPING FOREST.

Andricus globuli. Common. First appearance noted August 28th.

Andricus inflator. Common. I have not found this gall so abundant in Epping Forest as in many other localities. When the gall has grown old and woody, buds are produced upon it, which eventually form twigs, so that these galls do not prevent the growth of the tree. I have often found catkins growing from buds situated on the galls of this species.

When young they are light yellow in colour, the apex being a very pronounced red or crimson.

First appearance noted, May 10th.

(15.) Agamic Generation. V. *Andricus collaris* (Htg.)
Inquiline. *Synergus nervosus* (Htg.)
Gall.

Found in the bud, usually only just protruding from among the scales. This, however, is not always the case, as I have often found specimens of this gall with only the basal portion enveloped by the bud scales. The gall penetrates deeply into the bud axis. *Colour*: Reddish brown when fresh. The extreme apex, which is pointed, is lighter in colour, surrounded by a dark brownish ring.

Imago.

Colour: Black, shining. *Antennae*: Dark. Basal joints, reddish. *Thorax*: Smooth and shining, pronotum and base of mesonotum, reddish. Scutellum, reddish brown. *Abdomen*: Dark, ventral surface may be reddish. *Legs*: Reddish yellow, coxae and sometimes bases of femora, dark. *Wings*: Hyaline.

(15.) Sexual Generation. VA. *Andricus curvator* (Thoms.)

Inquilines. *Synergus albipes*, *S. facialis* (Htg.), and *S. radiatus* (Mayr.)

Gall.

Appears on the leaves, causing irregular thickening. An inner oval yellowish gall contains the larva. These galls twist and distort the leaves, which in some cases do not mature at all. They are often numerous, causing continuous swellings. They often appear on young twigs, twisting them and causing them to grow in a permanently bent condition.

Imago.

Colour: Black. *Antennae*: Dark, pale at base; Apex gradually thickened. *Thorax*: Without sculpture, smooth. *Abdomen*: Black and shining. *Legs*: Testaceous; coxae always, and femora sometimes, dark. *Wings*: Hyaline.

Account of Generation Cycle.

When the *A. collaris* galls mature, a year and a half elapses before the insects emerge. This takes place at the end of March or the beginning of April.

The eggs are laid in the rudimentary leaves at the centre of the bud. These leaves are distorted and thickened by the resulting *A. curvator* galls, which appear in May, the flies emerging from them in June. These, after copulation, lay one egg in each bud, the *A. collaris* galls appearing in September, and sometimes in August. In October the gall falls to the ground, but the flies do not emerge until March or April of the second year.

OCCURRENCE IN EPPING FOREST.

Andricus collaris. Abundant. These galls do not always fall to the ground when mature, but those that do not I have usually found to be parasitised. First appearance noted, August 22nd.

Andricus curvator. Very plentiful. I have occasionally met with this gall on the fruit stalk at the time when the acorn has just begun to form. The stalk is then bent nearly double, and much thickened. This gall, however, is usually found on the leaf. First appearance noted, May 14th.

(16). Agamic Generation. VI. *Andricus callidoma* (Thoms).

Inquilines. *Synergus nervosus* (Htg.) and *S. vulgaris* (Htg.)

Gall.

Situated in the axils of the leaves. *Shape* : Cylindrical, pointed at the apex, furnished with conspicuous longitudinal ribs. It grows on a long thin stalk. *Colour* : Green ; ribs red.

Imago.

Colour : Reddish yellow. *Antennae* : Dark. *Abdomen* : Dorsal surface dark brown. *Legs* : Brownish yellow, posterior tibiae dark, very like *A. quadrilineatus* ; some specimens are practically identical, though both are very variable.

(16.) Sexual Generation. VIA. **Andricus cirratus** (Adler.)
Gall.

Appears on the stalk of the male catkin. Green when young, becoming yellow and brown with age, furnished with long white hairs, especially at the apex. I have found specimens covered with long straggling white hairs, which are not dense, the galls being yellowish, small and rounded. Three or four galls may be found together, forming a more or less woolly mass.

Imago.

Colour : Black. *Antennae* : Testaceous, apices dark. *Thorax* : Tegulae entirely, and pronotum partially yellow. *Abdomen* dark above, sides reddish yellow, ventral surface reddish brown. *Legs* : Yellow ; posterior trochanters and bases of coxae dark. *Wings* : Hyaline.

Account of Generation Cycle.

When the larvæ are mature, the *A. callidoma* galls lose their colour and become a uniform dull brown. The insects emerge in April, and lay their eggs on or between the anthers. The resulting gall, *A. cirratus*, appears in May, the flies emerging about the middle of June.

After copulation they proceed to oviposit in the axillary buds. About the middle of July the galls of *A. callidoma* appear from the buds, though in many cases they do not appear until August.

When mature these galls fall to the ground, the flies appearing either in the following spring or not until April of the second year.

OCCURRENCE IN EPPING FOREST.

Andricus callidoma. Fairly plentiful. This gall, when parasitised, may remain on the tree for some time before falling to the ground ; brown and dry galls may often be found still attached quite late in the year. First appearance noted, August 21st.

Andricus cirratus. Not common. A number of galls may appear on the same catkin, but often there are only two or three present. First appearance noted May 18th.

(17.) Agamic Generation. VII. *Andricus fecundatrix* (Htg.)

Inquilines. *Synergus melanopus* (Htg.), *S. vulgaris* (Htg.)
Gall.

The gall grows from the bud, and somewhat resembles a hop; it is made up of numerous enlarged scales, which surround the hard woody inner gall, situated at their base. This inner gall is usually thrust out, and falls to the ground in late summer, but this is not always the case. *Colour*: The true inner gall is yellowish green; the scales are green, edged with brown, when young, becoming entirely brown later.

Imago.

Colour: Blackish. *Thorax*: Covered with white silky hairs with two broad stripes towards the outer portion of the parapsidal furrows. These stripes are smooth and glabrous. The other portions of the thorax are dull and rugose. *Abdomen*: Black, shining, somewhat reddish at the sides. *Legs*: Usually dark, front tibiae, with strong erect hairs.

(17.) Sexual Generation. VIIA. *Andricus pilosus* (Adler.)

These galls which occur on the male catkins, either singly or many together, are covered with hairs. *Colour*: Green at first, becoming brown with age. *Shape*: Oval, walls thin, apex prominent.

I was unable to find this gall at Epping Forest.

Imago.

Black in colour, with the thorax smooth and slightly shining, and the abdomen a dull black. The *Antennae* are black or brownish black, and the *legs* are yellowish.

Account of Generation Cycle.

The insects emerge from the *A. fecundatrix* galls in April. The ova are laid in the anthers of the catkin, one egg in each anther. When the male flowers develop in May, the *A. pilosus* galls appear in variable numbers, but usually a good many on each catkin. From these galls the flies emerge in June, and lay one egg in a bud, many buds being pierced by each insect. Galls

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begin to form in July, at the beginning of the month. These are *A. fecundatrix* galls, and they do not as a rule give up the perfect insects until April of the second or third year. In August of the first year, and before it is mature, the inner gall is often thrust out by the scales and falls to the ground.

OCCURRENCE IN EPPING FOREST.

Andricus fecundatrix. Fairly abundant. In some instances twigs of some length may have galls appearing from every bud. I have often found the inner galls to be parasitised and polythalamous. The scales which form a covering for the inner gall may remain upon the tree for a considerable period; they often continue on the tree during the following summer. First appearance noted, July 12th.

I was unable to find any *A. pilosus* galls in Epping Forest.

(18.) Agamic Generation. VIII. *Andricus malpighii* (Adler).

Gall.

Very like *A. callidoma*, and found also in the axils of the leaves. It can be told, however, by the absence of the long thin stalk, which gives the gall a plumper appearance, the stalk, if present, being very short and thick. Parasitised *A. callidoma* galls often resemble *A. malpighii*, but as the latter appear at a much later date they can usually be distinguished.

Imago.

Can scarcely be told from *A. callidoma*, but it is usually darker in colour; the femora and upper half of the tibiae are dark.

(18.) Sexual Generation. VIIIA. *Andricus nudus*. (Adler).

Gall.

Found on the male catkins between the anthers. Glabrous, but with sometimes a few hairs at the apex. Colour: Green when young, becoming yellow at maturity. Shape: Elongated oval.

Imago.

Colour: Black. Antennae: Dark, basal 4-5 joints yellow. Thorax: Slightly shining. Abdomen: Paler than the thorax, ventral surface usually testaceous. Legs: Yellow, the base of the anterior coxae may be dark.

Account of the Generation Cycle.

The flies from the *A. malpighii* galls emerge in April and oviposit in the male catkin. *A. nudus* galls are formed in May,

the sexual generation appearing from them at about the beginning of June. These insects oviposit in the axillary buds. In September, or not until October in some cases, the *A. malpighii* galls are formed. The full grown larva, however, does not pupate until the following autumn, emerging in April of the second year. That is to say, the larva in an *A. malpighii* gall formed in the autumn of 1898 would not emerge as a perfect insect until April, 1900.

OCCURRENCE IN EPPING FOREST.

Andricus malpighii. Not common. I found some of these galls appearing from buds of twigs growing adventitiously on the trunk of the tree. They appear much later than is the case with the *A. callidoma* galls. First appearance noted, September 19th.

I was not able to obtain any *Andricus nudus* galls in Epping Forest.

(19). Agamic Generation. IX. *Andricus autumnalis* (Htg.)

Inquilines. *Synergus nervosus* (Htg.), *S. apicalis* (Htg.)
S. ruficornis (Htg.)

Gall.

Like *A. globuli*, this gall is formed from the bud its base being surrounded with bud scales.

The real gall is covered with a brownish green sappy rind which subsequently falls off. If the gall is not removed, the rind falls off, but otherwise it remains on the gall, becoming longitudinally ridged. *Shape*: Oval, apex pointed. *Colour*: Brownish green.

Imago.

Colour: Black. *Antennae*: Brownish, basal two joints yellowish red. *Thorax*: Black, wrinkled and dull. *Abdomen*: Shining black above, reddish brown below. *Legs*: Dark yellowish red, trochanters and bases of coxae darker.

(19). Sexual Generation. IXa. *Andricus ramuli* (Linn.)

Inquilines. *Synergus facialis* (Htg.) and *S. radiatus* (Mayr).

Gall.

Develops either from a male flower bud or from a leaf bud. The gall itself is brownish yellow in colour, covered thickly with white matted hairs giving it the appearance of

white felt, or lump of cotton wool. The size depends upon the number of galls collected together.

Imago.

Colour: Reddish yellow, shining. *Antennae*: Entirely yellow. *Thorax*: Mesonotum finely punctured and dull. *Abdomen*: Darker on the dorsal surface in the male than in the female, in the latter it is more or less brownish. *Legs*: Uniformly yellow.

Account of Generation Cycle.

The insects emerge from the *A. autumnalis* galls in April, and oviposit either in the flower or leaf buds, laying a number of eggs in each bud. According to Adler, flower buds are usually selected because they mature earlier. About the middle of July the sexual generations appears from these galls, and the eggs are laid in the axillary buds. In October the *A. autumnalis* galls appear; these mature at the end of the month, and fall to the ground, the fly appearing in April of the second year,

OCCURRENCE IN EPPING FOREST.

Andricus autumnalis. Not very common. I was only able to find a few specimens of this gall. First appearance noted, September 30th.

Andricus ramuli. Not plentiful. These galls, as a rule, were solitary, and appeared on the catkin more frequently than from the leaf buds, but I occasionally found two or three matted together into one formation. The thick felt-like covering becomes reddish-brown with age. First appearance noted, May 26th.

(20.) Agamic Generation. X. *Andricus ostreus* (Htg.) Inquilines. *Synergus tscheki* (Mayr) and *S. tristis* (Mayr). Gall.

Appears from the veins on the underside of the leaf. It is covered at the sides when young by two scale-like pieces which give it the popular name of "the oyster gall." *Colour*: Yellowish, usually with reddish spots when young, sometimes entirely red, yellowish brown when old. *Shape*: Usually oval, but sometimes globular.

Imago.

Colour: Brownish black, sometimes quite black. *Antennae*: Dark, thickening towards the apex, paler at the base. *Thorax*: Keels on the median segment very pronounced and curved. May be streaked with dark rufous. Usually slightly and finely pubescent. *Abdomen*: Shining. *Legs*: Reddish, becoming darker towards the base. *Wings*: Somewhat clouded.

The gall appears in August or September, falling to the ground in October before the larva is mature. The flies emerge at the end of October, or even as late as November, and prick the buds for oviposition. Sometimes the perfect insect does not emerge until March of the following year.

Many parasitised galls remain on the leaves during the winter, either on the ground or still attached to the tree.

Though I have been able to breed the fly, I have not succeeded in carrying out any successful experiment with regard to the generation cycle of this species.

Dr. Adler, who mentions this species as belonging to the genus *Neuroterus*, but at the same time proposes to separate it from that genus, gives *Neuroterus aprilinus* as the probable sexual generation, in which view he is supported by Professor Mayr.

As mentioned in the case of *Neuroterus aprilinus*, other forms are given by different authors as representing the sexual generation of this species.

OCCURRENCE IN EPPING FOREST.

Andricus ostreus. Very abundant. Although this gall usually occurs on the back of the leaf, this is not always the case, and it may occasionally be found on the front. As a rule it is situated on the mid rib, but sometimes on the lateral veins. There may be one or more galls on each leaf. I have sometimes found as many as six.

There is a distinct mark or scar left on the leaf vein after the gall has fallen, due to the two dried membranes, which were originally present at the base of the gall on each side. First appearance noted, August 14th.

(21). Agamic Form. XI. *Andricus solitarius* (Fonsc). Iniquilines. *Synergus vulgaris* (Htg.), *S. facialis* (Htg.) and *S. radiatus* (Mayr).

Gall.

Spindle shaped and pointed, widest near the base. Green in colour when young, reddish brown later. A fresh gall is covered with ferruginous hair; this is subsequently worn off, the gall becoming quite smooth and brown. The larval cavity is fairly large and the walls comparatively thin. It is found both in the terminal and axillary buds.

Imago.

Colour : Reddish yellow. *Antennae* : Dark, basal joints pale yellow. *Thorax* : Pubescent and shagreened. Pro- and meso-notum more or less dark, scutellar foveae and centre of medium segment, black. *Abdomen* : Third segment impunctate. *Legs* : Pale yellow ; base of coxae, hind tibiae and tarsi, may be infuscated. *Wings* : Smoky, especially before the cubitus.

The *A. solitarius* galls are found in June, July and August, maturing in September.

OCURRENCE IN EPPING FOREST.

Fairly abundant. Two or three galls may occur on the same twig. First appearance noted, June 26th.

I have taken this gall in Kent, Devon, Cheshire, Warwick, Salop, and Merioneth, which proves that it is widely distributed. Cameron mentions it as not uncommon in Scotland and Nottinghamshire, and it has also been taken in the Hastings district.

(22). Agamic Forms. XII. *Andricus seminationis*. (Gir).

Inquilines. *Synergus facialis* (Htg.) and *S. albipes* (Htg.)

Gall.

Spindle shaped, somewhat like *A. callidoma* and *A. malpighii*. They may be with or without a stalk ; they are ribbed longitudinally and covered with short downy hairs especially near the apex. They occur either on the catkin or on the leaf. *Colour* : Green, the longitudinal ribs usually red.

Imago.

Not distinguishable in any reliable way from *Andricus quadrilineatus* ; as in the latter, the colour varies very considerably from yellowish brown to dark brown.

These galls appear usually at the beginning of June, and then, according to Adler, they fall to the ground. I have, however, found them on the catkin stems as late as the middle of October ; these possibly were parasitised. They occur on the catkin stems and also on the leaf ; they distort the latter and cause the former to swell. This swelling commences three or four weeks before the galls themselves appear. The flies emerge in the following April or not until the second year. The eggs are laid in the buds in the middle of April.

OCURRENCE IN EPPING FOREST.

I have found these galls on a few trees only, but they were very numerous whenever they did appear, the catkin stems in

all cases being very much distorted and swollen. This swelling commenced about the beginning of May. The galls themselves began to appear at the beginning of June and continued until the end of August, as I found some fresh galls on the 22nd of the latter month. Cameron mentions this species as occurring in Mugdoch Wood and I have also taken it in Kent, but I have not heard of it from any other locality.

(23.) Agamic Form. XIII. **Andricus quadrilineatus** (Htg.)

Inquiline. *Synergus facialis* (Htg.).

Gall.

Oval in shape, somewhat flattened at the ends. They may be smooth, but are usually furrowed. Colour varies between green, yellow, and red. They are found on the flowering catkin.

Imago.

Very variable. *Colour* : Usually brownish red. *Antennae* : Dark, infuscated, or nearly black. *Thorax* : Two lines on the median lobe of the mesonotum and one on the lateral and scutellae foveae, black. A short whitish pubescence is present on the pleurae and median segment. Scutellum finely rugulose. *Abdomen* : Dark brown above. *Legs* : Brownish yellow, coxæ, bases of femora and outer margin of tibiae, dark. *Wings* : Hyaline, nervures dark brownish. Cubitus and base of radial cellule, very slightly infuscated.

The *A quadrilineatus* galls appear in May. The flies emerge in the following April. They prick the buds of the male catkin about the middle of April, and the galls are mature at the beginning of June. In a great many cases the flies do not emerge until April of the second year.

OCCURRENCE IN EPPING FOREST.

Very abundant. These galls occur in numbers on the catkins. First appearance noted, May 18th.

(24.) Agamic Form. XIV. **Andricus albopunctata** (Schtdl.).

Inquelines. *Synergus radiatus* (Htg.) and *S. facialis* (Mayr).

Gall.

Grows from a bud, varying a great deal in colour from green to reddish brown, usually marked with light longitudinal spots. In many cases these galls greatly resemble buds; in others, where the gall grows much larger, they are somewhat similar to acorns without the cup. They vary in shape, but as a rule become narrower towards the apex.

Imago.

Very variable, not distinguishable from *A. quadrilineatus*.

The *A. albopunctata* galls may become wrinkled when old, and in some cases they adhere to the bud axis. They appear at the end of April; mature very quickly, falling to the ground in May, and occasionally not until June. The flies emerge in the following spring, or sometimes not until April of the second year. The eggs are laid in the buds about the middle of April.

OCCURRENCE IN EPPING FOREST.

Fairly common, but not so much so as in many places. They have very much the appearance of buds, and on this account may be easily passed over without notice. First appearance noted, April 29th.

Genus BIORHIZA (Westwood).

The two generations of this genus are exceedingly alike, and, in some cases, could scarcely be differentiated, except that in the sexual forms, the male is never apterous or with the wings rudimentary, and the female is usually furnished with wings, though sometimes these may be absent, or only present in a partially developed state.

The colour in both forms is yellowish brown.

There is, so far as we know, only one European species, *Biorhiza aptera-terminalis* (Fab.)

The great resemblance which exists between *Biorhiza terminalis* and *B. aptera* extends to the ovipositors also, although, as a rule, among the Cynipidæ the ovipositors differ even when the other parts are almost, if not quite, identical. The difference between ovipositors is due to the method of oviposition, which varies according to the position in which the egg is to be laid; in this case the position of the egg is very different in the two generations, but as the method employed in depositing the egg does not differ, the form of ovipositor remains the same in each case. The great likeness which exists between so many different species of this family is due to want of difference in their mode of life, so that surroundings cannot act upon them to alter their characters, the chief variations occurring in the gall instead.

This accounts for the similarity in outward appearance between the sexual forms of the genus *Dryophanta* and the corresponding forms of the genus *Neuroterus*, which were at one

time included in the same genus. This similarity is much greater between the sexual species of the genus *Dryophanta* themselves which cannot in some cases be separated at all, as for instance, *D. tachenbergi* and *D. similis* which are practically identical.

(25). Agamic Generation. I. **Biorhiza aptera** (Fab).
Gall.

Situated on the roots of the oak, either singly or in masses. According to Adler they may also appear on the leaf stalk, but those that he procured in this situation soon dried up. I have myself never found the gall anywhere but on the root. *Colour* : Pink to white when young, in some cases with a purplish tinge, becoming brown with age. Soft at first, hard and woody later.

Imago.

Colour : Yellow to reddish brown. *Antennae* : Darker towards apex. *Thorax* : Parapsidal furrows distinct and usually complete, mesonotum especially in the centre, slightly shining. Meso pleurae pilose. Scutellum and propleurae finely punctured. *Abdomen* : Darker towards the apex. *Legs* : Yellowish brown. *Wings* : None.

(25). Sexual Generation. IA. **Biorhiza terminalis** (Fab).
Inquilines. *Synergus facialis* (Htg.) and *S. melanopus* (Htg).
Gall.

Grows chiefly on the terminal buds, but is frequently met with on the lateral ones. Large, circular, and many celled, soft and spongy at first, becoming hard and woody later. *Colour* : Pink or bright red when young, turning brown with age.

Imago.

Colour : Yellow to yellowish red. *Antennae* : Darker towards the apex. *Thorax* : Mesonotum shining and finely punctured. Pleurae shining and impunctate. Parapsidal furrows distinct. Scutellum wrinkled, with two basal foveae. *Abdomen* : Brownish, on the dorsal surface darker in colour. *Legs* : Yellowish red. *Wings* : Hyaline. Nervures brownish.

Account of Generation Cycle.

From the *Biorhiza aptera* galls the flies emerge in November, December, and January (occasionally in March). They creep up the trunk and lay their eggs very often high up in the tree. The bud is first punctured with the ovipositor until riddled with canals, into which the eggs are afterwards pushed, lying in a mass at the base of the bud. The resulting *Biorhiza terminalis*

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galls appear in May, maturing at the end of the month. During June the sexual generation of flies emerges, oviposition taking place on the root (sometimes, according to Adler, in the leaf bud). The females may be apterous, but the males are always winged.

OCCURRENCE IN EPPING FOREST.

Biorhiza aptera. Fairly plentiful and probably abundant, but less noticeable on account of their situation.

Biorhiza terminalis. Very abundant. Occur singly or two or three together, many growing from the terminal buds. They are found also growing from the axillary buds. They vary greatly both in size and colour, and are very subject to parasites and commensals of almost every insect order.

Some trees were simply a mass of galls, which remain on the tree in many cases during the greater part of the winter. First appearance noted, May 10th.

Genus TRIGONASPIS (Hartig).

The Agamic Forms of this genus are wingless like the corresponding forms of the genus *Biorhiza*, but they are all much smaller in size; the head is also dilated behind the eyes, and the ovipositors differ considerably. The sexual form is very well marked and entirely different to the agamic generation, the wings being large and well formed and the abdomen red in colour. There is only one British species at present known.

It has not been ascertained for what reason there is an egg resting stage in the agamic generation. The eggs are deposited in the leaf by the sexual flies, at the end of May or beginning of June, but the larvae do not leave the eggs, and gall growth does not commence, until September.

The reason for the apterous condition of the agamic generation is probably due to the fact that the perfect insects do not require their wings before oviposition as the eggs are deposited in the adventitious buds on the trunks of the trees, usually near the ground, or in buds on young stems from six inches to a foot in height, which grow up around the trees from acorns which have fallen to the ground and germinated. It is quite the exception to find galls at any great distance from the ground.

The same thing applies to those *Biorhiza terminalis* females which are apterous, namely, that they would appear to be

gradually getting rid of wings which are of no service to them and are even a hindrance when laying their eggs in the roots of the tree.

(26).—Agamic Generation. I. **Trigonaspis renum** (Htg.)
Inquiline. *Synergus thaumacera* (Dal.)
Gall.

The galls are situated on the back of the leaf, usually there are a great number on each leaf. They are small irregular galls very often kidney-shaped, but the form varies. Greenish white to red in colour, becoming brown later, when mature, unless parasitised. They are arranged along the leaf veins.

Imago.

Colour : Brownish to yellowish red. *Antennæ* : Thirteen-jointed. *Thorax* : Punctured, dull ; scutellum : hairy. *Abdomen* : Shining, vertex shagreened ; almost sessile. *Legs* : Lighter yellow than the body ; claws : simple. *Wings* : None.

(26).—Sexual generation. IA. **Trigonaspis crustalis** (Htg.)

Inquilines. *Synergus thaumacera* (Dal.) *S. facialis* and *S. pallicornis* (Htg.)

Gall.

Appears from adventitious buds near the base of the oak trunk, on shoots growing from the trunk, or on shoots growing out of the ground from acorns dropped from the trees. *Shape* : Globular, size variable. Apex sometimes pointed. *Colour* : White, yellowish white, pink, or bright red.

Imago.

Colour : Black (abdomen, red), shining. *Antennæ* : Dull reddish brown at the base, darker towards apex. *Thorax* : Black. *Head* : Black. *Abdomen* : Red or bright orange, shining, distinctly pedunculate. *Legs* : Orange, base of coxae infuscated. *Wings* : Long and well developed, clouded in front of the cubitus and often at the base of the radial cellule.

Account of the Generation Cycle.

The flies from the *Trigonaspis renum* galls appear in December and January, though sometimes later. The eggs are laid in the adventitious buds on the tree trunks, or on buds on young stems. In April the small red gall of *Trigonaspis crustalis* appears, but in cases where oviposition has taken place later, these galls do not form until as late as the middle of May. From the end of May until the middle of June the flies emerge, the females pricking

the veins of the undersurface of the tender leaves. Not until September do the galls of *Trigonaspsis renum* appear, and they then take about three weeks to mature, falling to the ground in October. The galls turn brown when the larvae matures, the perfect insects emerging during the winter, or not until the second year.

OCCURRENCE IN EPPING FOREST.

Trigonaspsis renum. Extremely common. First appearance noted, September 22nd.

Trigonaspsis crustalis. Very abundant. Commonly found on young oak plants about a foot in height, in which case a gall may be present in every bud both above and below ground.

In the case of an old pollard oak, where the adventitious buds growing on the trunk were very numerous, I found the galls so plentiful as to practically cover the whole of the bark near the base of the tree. Although when situated on the trunk the galls are usually to be found near the ground, I have occasionally found them as much as from six to eight feet up the trunk. The galls may appear from the leaf stalk, and in one case I found a gall arising direct from a leaf. First appearance noted, May 3rd.

From a typical example of the galls of this species growing on a young oak plant which I supplied from Epping Forest, a coloured model in wax has been made and exhibited at the Natural History Museum, South Kensington.

Genus CYNIPS (*Linnaeus*).

This genus contains only one British species, which is the largest of our gall-making Cynipidae. It is easily distinguished from the insects of any other genus by the presence on the abdomen of a rich pubescence of a silky nature.

There is only one generation a year, which is agamic, no males being known.

Although this genus includes only one British species, there are eighteen known in Europe, all of which are very difficult to separate as perfect insects. This gall, like that of *Biorhiza terminalis*, remains on the tree for a considerable period.

When they occur in great numbers on a single plant, as is often the case with young stock, they are exceedingly injurious. I have seen many young trees covered with the galls, completely stunted and practically useless.

The galls are of little or no use for ink making purposes, because as Cameron remarks, they contain only seventeen per cent. of tannic acid as against fifty per cent. in Aleppo and other galls.

The presence of tannic acid in the gall acts perhaps as a protection for the enclosed larva, though birds often peck the galls open to get at the grub, in spite of their bitter properties.

The galls are very liable to parasitic infestation and harbour inquilines and commensals; the presence of these intruders can often be told by various wart-like excrescences which appear on the outer surface of the galls.

(27). Agamic. I. **Cynips kollari** (Htg.)

Inquilines. *Synergus pallicornis*, *S. melanopus* (Htg.) and *S. reinhardi* (Mayr).

Gall.

Appears from terminal and axillary buds. Round in shape, varying in size up to 3 mm. Green to brownish red when young often at this time marked with darker spots, the apex is usually drawn out and slightly bent. As they become older and grow larger they assume a golden yellow colour or remain quite green; in both cases they turn brown subsequently, at maturity.

Single celled unless parasitised.

Very often two galls may be found joined in one, in which case there is usually one larval cell containing a single larva. The gall substance is much harder immediately around the larval chamber than elsewhere, with the exception of the outer epidermal tissue of the gall.

Imago.

Colour: Reddish yellow, which varies slightly in intensity. **Antennae:** 13-jointed, basal joint pale, third joint longer than the others. **Thorax:** Pubescent, parapsidal furrows complete, scutellum completely covers the metanotum which, like the median segment, is very dark. **Abdomen:** Smooth, shining, more or less black above, partially covered with a silky pubescence. **Ovipositor:** Long and spiral. **Legs:** Yellow, paler than the body, fore tibiae fringed with hairs. **Wings:** Long, hyaline, and slightly hairy.

The *Cynips kollari* galls as a rule mature in September, the flies emerging in October. Sometimes they emerge early in September, while some remain in the galls during the winter, appearing in April or May.

The eggs are laid in the buds.

According to Beyerinck, who carried on experiments with this fly in 1881, the first sign of gall formation occurs at the end of May, maturity being reached in September, and oviposition taking place in October. According to my own observations, the galls are still very small at the beginning of July, dark reddish brown in colour with a prominent red apex; by the second week in July they had assumed a more globular appearance and changed their purple colour for green, becoming golden yellow before turning brown at the end of August. When quite young I found in many instances that there were two galls growing out from the axil of the leaf, one being of larger size than the other as a rule, in which case the smaller dried up. In other cases both galls continued to grow together. The prominent apex of the young gall is represented on the mature gall by a small point.

When parasitised the galls are often smaller and much darker in colour than the non-parasitised galls. The difference is sometimes very noticeable. In such cases, on making a section through one of these galls it will often be noticed that towards the centre there is a circle consisting of five or six cells of Synergid larvae which have exterminated the cell of the original maker of the gall together with its occupant.

Over Europe the gall is widely distributed, but it is not found very far north. It has been known in Britain for about seventy years, and was probably introduced about 1830. It first made its appearance in Devonshire, whence it has spread over England and Scotland. I have found it abundant this year in different parts of Kent, Devon, Monmouth, Brecon, and Cheshire. In Epping Forest it is very common, but I have not found it so abundant as in many other localities. First appearance noted, June 30th.

In conclusion, I may add that my researches have extended over a small portion of Epping Forest only, namely, that part

situated between Chingford and High Beach; also that I have been obliged to leave the district from time to time for short periods, which may account for the fact that I was unable to find some of the catkin galls such as *Andricus pilosus* and *A. nudus*, although the corresponding agamic generation *A. secundatrix* was abundant; and I also found *A. malpighi* later on in the year.

In the foregoing account I have perhaps added little to our knowledge of the oak gall-making Cynipidae. My object, however, has been, not only to make a list of the oak-galls I have met with in Epping Forest, and to add certain species to those which have already been found in Essex, but also to put what we already know in such a concise form as may stimulate future research by showing how exceedingly interesting the subject is, and how wide a field for inquiry and study remains still unexplored.

THE CORRESPONDING SOCIETIES' COMMITTEE OF THE BRITISH ASSOCIATION, SOUTHPORT, 1903.

REPORT OF THE CLUB'S DELEGATE.

F. W. RUDLER, F.G.S., President E.F.C., Secretary of the Conference of Delegates.

[Read November 28th, 1903.]

EXCEPTIONAL interest attached to the Conference of Delegates this year, inasmuch as the President of the Association, Sir Norman Lockyer, K.C.B., F.R.S., had undertaken to address the meeting on the necessity of organising Science, with special reference to the question whether the British Association could help in any way, and if so, whether the Corresponding Societies could take any part therein. This address was the outcome of recent activity on the part of the Corresponding Societies Committee. Last year that Committee approached the Council of the British Association with the view of securing some improvement in the means of communicating with the local Societies so as to aid more satisfactorily the work of some of the scientific Committees appointed by the Association. The

matter was referred by the Council to a Committee consisting of the President, the President-elect, and the General Officers of the Association, together with Professor Armstrong, F.R.S., Professor Meldola, F.R.S., and Professor Perry, F.R.S. This influential Committee reported in due course, and as their report contains some valuable suggestions of much interest to local Societies it seems desirable to quote from it rather fully:—

“The Committee have considered the communication from the Corresponding Societies Committee referred to them by the Council, and have examined into the general character of the work carried on by the Corresponding Societies, and the nature of the subjects discussed at the Conferences of Delegates held annually under the auspices of the British Association since the year 1885. They are of opinion that the range of subjects very fairly covers most of the branches of scientific investigation in which local Societies might be expected to bear a part. New subjects are added from time to time, and means have been taken by the Corresponding Societies Committee to give publicity to suggestions for any suitable line of investigation instigated by the Corresponding Societies themselves. Of the numerous branches of inquiry being carried on by British Association Committees in which the Corresponding Societies are invited year by year to take a part, some have been materially assisted by the Corresponding Societies or their individual members. The subjects suitable for investigation by local Societies are necessarily governed in their scope by local conditions, but among those already brought under the notice of the Corresponding Societies there are some of a general character which might very well be taken up systematically all over the country. The Committee do not consider it necessary to furnish the Council with a complete list of such specific subjects, as these are already included in the various Reports of the Corresponding Societies Committee. They desire, however, to call the attention of the Council to the necessity for systematic co-operation among the local Societies for the carrying out of investigations of such general importance as the various surveys, archaeological, ethnographic, photographic, and botanical, which have on several occasions been brought under the notice of the Corresponding Societies at the Conference of their Delegates. These and other investigations of a similarly wide range which may from time to time be suggested furnish ample work for the Corresponding Societies, and the Committee find that in certain districts considerable progress has been already made, or that steps are now being taken to organise the work already suggested.”

After certain suggestions with reference to the work of the Sectional and Organising Committees of the Association, the Report proceeds as follows:—

“In view of the increasing importance of science to the nation at large, your Committee desire to call the attention of the Council to the fact that in the Corresponding Societies the British Association has gathered in the various centres represented by these Societies practically all the scientific activity of the provinces. The number of Members and Associates at present on the list of the Corresponding Societies approaches 25,000, and no organisation is in

existence anywhere in the country better adapted than the British Association for stimulating, encouraging and co-ordinating all the work being carried on by the seventy Societies at present enrolled. Your Committee are of opinion that further encouragement should be given to these Societies and their individual working members by every means within the power of the Association, and with the object of keeping the Corresponding Societies in more permanent touch with the Association they suggest that an official invitation on behalf of the Council be addressed to the Societies through the Corresponding Societies Committee asking them to appoint standing British Association Sub-Committees to be elected by themselves with the object of dealing with all those subjects of investigation common to their Societies and to the British Association Committees, and to look after the general interests of science and scientific education throughout the provinces and provincial centres. Your Committee may point out that the only permanent bodies carrying out systematic scientific work under the auspices of the Association are the various Committees appointed by the Sections to undertake particular investigations and to report thereon to their respective Sections. The proposal now submitted is equivalent to a request that the Corresponding Societies should themselves appoint such Standing Committees for stimulating every branch of inquiry in which these Societies are co-operating with the Association. It is believed that the active workers in every Society would by this means be brought to realise more fully that their labours are contributing to the general advancement of science; and since the subjects at present brought under the notice of the Corresponding Societies cover practically every department of science represented by the Sections of the Association, it is hoped that these new British Association Sub-Committees of the Corresponding Societies may serve as nuclei for creating and maintaining locally public interest in every branch of scientific knowledge.

"Your Committee desire to lay special emphasis on the necessity for the extension of the scientific activity of the Corresponding Societies and the expert knowledge of many of their members in the direction of scientific education. They are of opinion that immense benefit would accrue to the country if the Corresponding Societies would keep this requirement especially in view with the object of securing adequate representation for scientific education on the Education Committees now being appointed under the new Act. The Educational Section of the Association having been but recently added, the Corresponding Societies have as yet not had much opportunity for taking part in this branch of the Association's work, and in view of the re-organisation in education now going on all over the country, your Committee are of opinion that no more opportune time is likely to occur for the influence of scientific organisations to make itself felt as a real factor in national education. They do not at the present juncture think it desirable to formulate any definite scheme detailing precise methods by which the Corresponding Societies might be of service to the cause of scientific education. Some Societies might prefer to unite to form Educational Consultative Committees of their own, and to place their services at the disposal of the Education Authority of their County or Borough. Others might prefer that individual members of their Societies should be added to the Education Committee, and others again might prefer to act indirectly by helping to foster public opinion in favour of that kind of education which it is the chief function of a scientific corporation, such as the British Association to promote. In view of the importance which your Com-

mittee attach to this branch of the work now proposed for the Corresponding Societies, it is suggested that the circular issued by the Council in accordance with the recommendation in this report should invite special expressions of opinion from the Societies through their delegates at the next Conference at Southport, so that if it is considered desirable that local effort in the cause not only of science but also of scientific education would be strengthened if backed up by the authority of the Association, the necessary steps may be taken by the Council to bring pressure to bear upon the Educational Committees through the Board of Education.

"The standing British Association Sub-committees of and appointed by the Corresponding Societies, whether for educational or any other branch of work, would, through the Corresponding Societies Committee, be in touch with the Association, and it would always be open for these sub-Committees to forward to the Corresponding Societies Committee suggested subjects for investigation or for discussion at the Conference."

In accordance with this report a letter was addressed to the President, the Secretary, and the Delegate of each of the Corresponding Societies, pointing out the advantage of securing closer co-operation with the Corresponding Societies Committee by the appointment of a Special Committee to deal with such subjects of investigation as are common to the Society and to the Committees of the British Association.

The report of the Corresponding Societies Committee states that a Conference was held on June 24 between the Committee of Council and the Corresponding Societies Committee, when it was decided that the questions raised in the Report of the Committee of Council should be brought forward for discussion at the Conference of Delegates at Southport.

The first meeting of the Delegates was held in the Chapel Street Congregational Schoolroom in Southport, on Thursday, September 10th, under the chairmanship of Mr. W. Whitaker, F.R.S. After the report of the Corresponding Societies Committee had been read, Mr. Whitaker explained that he occupied the chair in consequence of the absence of Mr. Herman Merivale, who had been nominated as chairman, and had early in the year accepted the nomination.

Sir Norman Lockyer then briefly addressed the delegates. He wished to hear their opinion with regard to some of the questions which he had raised in his Presidential Address. In that discourse he had advocated the formation of a great Guild of Science. "We in this Empire," said Sir Norman, "certainly need to organise science as much as in Germany they find the need to organise a navy. The German Navy League, which

has branches even in our Colonies, already has a membership of 630,000, and its income is nearly £20,000 a year. A British Science League of 500,000 with a sixpenny subscription would give us £12,000 a year, quite enough to begin with."

It was suggested that in the formation of such an organisation the Corresponding Societies might take an active part.

"The present moment [said the President] was very opportune for the formation of such a body, because you have throughout the kingdom, from Land's End to John O' Groats, a great number of councils—county councils, city councils, town councils, district councils, parish councils, and goodness knows what—and it struck me, if we could manage somehow to influence the debates of these bodies, it would be very much better for science, and ultimately, I think, very much to the benefit of the Association. I am a very humble person, a very hardworking man, and I have been working for the last forty years to try in my little way to get adopted some better views of science in this country. Well, I am a miserable failure, and all the people who have made similar endeavours are like me—miserable failures. We have done absolutely nothing. So far as my experience goes, all the attempts made by individuals during the last forty years—I can go back forty years in my own work—have been practically of no effect, and that was the reason why I thought it was possible that by some such organisation as I sketched last night we might do something better. That 'something better' is, to put it plainly, looking after votes. Unless we can control votes in the House of Commons and in the councils throughout the country, science will not be any better. If we can control votes science will be benefited; and scientific bodies working with a goal in view from one end of the country to the other would be a most important factor in our future national life. Of that I am perfectly convinced; but I am only an individual, and therefore I asked permission to come and listen to you, gentlemen, who have had more experience than I can claim to have, representing as you do different societies, and familiar with the conditions in your own localities, and therefore able to say whether it is possible to catch votes, to influence councils, and gradually to infuse a scientific spirit into the county councils, the town councils, and the district councils of England."

These remarks, coming from so high an authority as the President of the Association, were felt to have much weight, but the discussion revealed, as might be expected, certain difficulties of a practical character, and some divergence of opinion as to the objects which should engage the attention of the local societies.

Professor E. H. Griffith, of Cardiff, in an excellent speech, doubted the expediency of starting with the avowed object of catching votes, and rather dwelt on the necessity of bringing home to the working-man the value of science in its industrial applications.

"Let us appeal," he said, "to the 'man in the street' on the facts which must convince him that science is of abiding benefit

to him in his daily life. Let us get him imbued with that idea, and votes will follow."

Mr. W. F. Stanley, of Croydon, held that if science is to make headway in the future we must get hold of the "boy in the street," rather than the man. He pointed to the excellent results achieved by the various Polytechnics, and suggested that the local scientific societies should get into direct touch with these institutions.

"I think," remarked Mr. Stanley, "if our societies can affiliate themselves to the polytechnics, and have representatives on the committees of these bodies, which, so far as I am aware, are very anxious for their admission, we shall have begun to unite our societies together, and we shall be able to draw them to a focus."

Several high authorities on scientific education contributed to the further discussion of the subject. The Rev. J. O. Bevan, expressed his fear that the suggestions had come too late, and that efforts ought to have made long ago for securing the due representation of science on the various educational bodies which had recently been constituted. He referred to the unsatisfactory way in which science is, in many cases, introduced to the young student, and observed that

"Science is often at a discount in the minds of the public because, as a matter of fact, the science which is taught in some of our schools is, not to put too fine a point on it, no science at all. We want it taught by well-trained teachers, rather than that the children should be crammed with certain facts of science by a teacher, who, because he has just taken a course of twelve lessons in agriculture, for example, is supposed to know all about the nature of the soil, the value of manures, the rotation of crops, and so on. As a matter of fact he knows very little, and parents unite in holding him up to scorn. I do not want a cook who can present yards of certificates, and yet spoils my dinner. Science is at a disadvantage. Let us be careful; we not only want science taught, but we want it taught in a proper scientific way."

The Chairman (Mr. Whitaker) pointed out that at the Croydon Natural History Society, a junior class of members had been started. The young members pass into the Society as full members, when they become a certain age, without the formality of election, but merely by an increase in their subscription.

Mindful of the immense value of imbuing young people with scientific tastes, it seems to me that much good might arise from the general adoption of such a course as that which has been

introduced at Croydon. Is there any reason why the Essex Field Club should not, in like manner, institute a division for young members, who would at least be attracted by the excursions, and having acquired, by contact with naturalists, a love for the study of natural science, would pass in due course into the Club as ordinary members?

As the outcome of the discussion on the President's address the following resolution was ultimately proposed and carried unanimously—a similar resolution having been passed in the various sections:—

“That, as urged by the President in his address, it is desirable that scientific workers and persons interested in science be so organised that they may exert permanent influence on public opinion, in order more effectively to carry out the third object of this Association, originally laid down by its founders, viz., “To obtain a more general attention to the objects of science and the removal of any disadvantages of a public kind which impede its progress,” and that the Council be asked to take steps to promote such organisation.”

A paper was read by Mr. W. Rankin, B.Sc., of Leeds, on “The Methods and Results of a Botanical Survey of Counties.” The late Dr. Robert Smith, of Dundee, commenced such a survey in Scotland, and his brother, Dr. W. G. Smith, and Mr. Rankin have recently published the results of their work in Yorkshire. The chief object of this Botanical Survey is to reduce to certain well-defined terms the vegetation of a county, and then to examine the biological features of each term. The scenery is regarded as a function of the vegetation, as well as of the rocks. In the somewhat difficult area of the West Riding of Yorkshire, about fifteen groupings, or plant-associations, more or less well-marked, are distinguished. In the moorlands there are five types—the bilberry summit, the cotton-grass moor, the heather moor, the grass-heath, and the limestone hill pasture. Five groups are also recognised in the woods, namely coniferous upland, and lowland oak, ash-hazel copse and beach. The areas of cultivation include the lowland wheat and the upland oats. In some places a lowland swamp-vegetation is developed.

“The mapping of a large area is not the only end sought [observed Mr. Rankin]. In surveying any district, moorland, woodland, or wheatland, extensive notes are taken of the nature of the plant associations and the various conditions under which they exist. In order that our conclusions may be sounder, excursions are taken at all times of the year. Notes taken in one district are

compared with those taken in another, and similar. Thus a general list of plants representative of the association or area is finally arrived at. In a similar way are built up the lists of plants for all associations, and information obtained concerning their biological conditions.

"It will readily be seen that by our methods the plant species inhabiting a district are arranged in the associations as they are actually found, and not, as is almost invariably the case in local floras, in the groupings of the Natural Orders. In certain ways this alternative point of view is very advantageous, alike to the beginner whom it is sought to interest in Nature study as to the maturer naturalist, who can find in the solution of oecological problems motive for endless study and enjoyment. There is a danger of thinking that the robbing a countryside of its rarest plants, to be carried home, dried, labelled, and buried in sheets of paper, is the beginning and end of botany. The present method puts no premium on this; the commoner plants are the most observed, and yet there is a place in our scheme for the rarest. By regarding the trees, shrubs, flowers, grasses, mosses and moulds as individuals of one community, dependent in a variety of ways upon one another, rather than as items meet to be labelled, and put into compartments, one is led to study the biology of the vegetable kingdom, to use the microscope, and through it to see visions of a thousand problems, some answered, many awaiting answer. And yet the systematic side of the science is not obscured."

Here in Essex, it seems to me, there is room for attempting to carry out such a vegetation-survey as that commenced in the north. Our Club has contributed materially to a knowledge of the flora of the county; but the new method is to view the local plants in their relation to soil, climate, and other physical conditions, which are controlling features in plant-distribution. A map of Essex showing the vegetation-districts sketched out on the new lines has yet to be constructed. Not that the floristic method of plant-study is in any way to be displaced; it is simply to be supplemented by a general view of the distribution of vegetable life, capable of cartographical expression.

A short communication was sent to Southport by our esteemed member, Mr. Holmes, calling attention to certain omissions in the new edition of some of the Ordnance Survey Maps, on the 6in. scale. On the older map there occurs at one spot in Greenwich Park the words "Roman Remains," and at a neighbouring place just outside the park, the map gives the information, "Roman Remains found here." In the newer map of the same district (edition of 1894-96) these words are omitted. The curtailment of any archæological information known to be well founded, is a matter to which local societies may fairly call attention in relation to the maps of their respective localities.

The main feature of the second Conference of Delegates, held on Tuesday, Sept. 15, was a valuable communication from our Secretary, Mr. William Cole. Under the title of "A suggestion with respect to Exploration and Registration Work for County Local Societies," the writer pointed out the way in which local scientific activity might be encouraged by financial assistance from the Education Committees of our County Councils.

[These suggestions are printed on another page (p. 183). Ed.]

Mr. Cole's suggestions were well received by the delegates, and have since been sympathetically discussed by the Corresponding Societies Committee. Certain legal difficulties with respect to the allocation of the Technical Instruction money have, however, been raised; but it may be hoped that these in due course will be overcome.

Mr. Herbert Stone, the President of the Birmingham Natural History and Philosophical Society, submitted a letter relating to the question of railway fares for members of Local Societies on excursions. He held that tickets at reduced fares should be granted to members individually, and not necessarily going in parties. Such a privilege, it appears, is conceded to anglers and golfers, but has been refused to members of natural history societies.

The Assistant-Secretary of the Royal Meteorological Society appealed to the various local societies for copies of any papers and reports which they may publish relating to meteorology, in order that the titles may duly appear in the *International Catalogue of Scientific Literature*, which is being assisted, so far as British meteorology is concerned, by the Society.

The Rev. T. R. R. Stebbing, F.R.S., begged the delegates to assist him in obtaining specimens of well-shrimps, for his report on the Underground Fauna of Great Britain. These little freshwater crustaceans are apt to escape notice, or to be considered not worth collecting.

Miss Sargent, of the Holmesdale Natural History Club, expressed her desire to obtain information from local naturalists, in connection with her investigations on British orchids.

She is anxious to receive particulars as to the length of time in the year during which the *leaves* of any native orchid are above ground.

[The leaves are commonly so inconspicuous that they escape notice out of the flowering seasons].

Information is also solicited as to the reproduction of such species by means of seed under natural conditions.

(a) What species produce seed freely or at all ?

(b) In the case of each species examined, are seedlings found in the neighbourhood of the parent plants, and do they seem to survive the first winter ?

(c) In the case of young plants—that is, those which have not flowered—can those which have grown from seed be easily distinguished from vegetative shoots when such occur ?

(d) In general, what proportion of the young plants in each species are seedlings ?

Miss Sargent, like a true naturalist, observed that she should like the information to be obtained, as far as possible, without rooting up the clumps, which is rather like killing the goose which lays the golden eggs. Drawings of germinating seeds would be acceptable.

Mr. J. David Thompson, of Washington, D.C., U.S.A., addressed the delegates, and explained that he had been appointed editor of a *Handbook of the Learned Societies of the World*, to be issued by the Carnegie Institute. For the purpose of this work he asked Secretaries to send him full information respecting their Societies.

Thus ended the Southport Conference—a meeting which promises to be memorable, inasmuch as it may mark a new departure in the work of many of our local Societies, by extending their sphere of usefulness to the promotion of scientific education throughout the country.

A SUGGESTION WITH RESPECT TO EXPLORATION AND REGISTRATION WORK FOR COUNTY LOCAL SOCIETIES.

By W. COLE, F.L.S., F.E.S., Hon. Sec. Essex Field Club.

[Being a paper read at the Southport Meeting of the Corresponding Societies Committee of the British Association, September 15th, 1903.]

HAVING been Secretary to a registered local scientific society during the whole period of the life of the Corresponding Societies Committee of the British Association, I have been impressed with the number and variety of the subjects recommended to the attention of local societies by the Com-

1 This paper will be printed in the Report of the British Association, but we reproduce it in order to gather the opinions of our members on the proposal.—Ed.

mittee from year to year. I have also been struck with the lack of practicability of many of these recommendations from my point of view—that is, of one having the success and progress of his society at heart. Such matters as “The Collection of Statistics concerning Trained Chemists employed in English Chemical Industries”; investigations concerning “The Resistance of Road Vehicles to Traction,” or the “Consideration of means by which better practical effect can be given to the introduction of the Screw Gauge proposed by the Association in 1884,” and the like, although subjects of professional importance, are but little adapted to enlist the co-operation of a body of amateur biologists, geologists, and archæologists. It seems to me that the subjects most likely to prove attractive to the members of the greater number of our local Societies are those connected with such branches of science as are within the opportunities and abilities of amateur observers, and which at the same time are such as will arouse the enthusiasm and “county-patriotism” of the supporters of the Societies. It is difficult at all times to obtain a sufficient number of members to permit of the carrying out of the necessary work of the Societies (meetings, publications, etc.), and it is still more arduous to collect funds for any piece of work supplemental to the routine business. I suggest that local Societies will best aid in their humble way the progress of science by confining their energies to the acknowledged three main objects of their existence—the minute study of the natural history and archæology of the counties; in educational work of a propagandist character; and in assisting in the formation of well-planned local museums and scientific libraries in their own districts.

All holding similar views will cordially approve of such pieces of work as the photographic survey of a county, or of the botanical survey advocated in a paper placed upon the agenda at the present meeting. And to be welcomed is the project for the preparation of a map index to prehistoric remains, so ably advocated by Mr. C. H. Read, F.S.A., at the Belfast meeting of this Committee.² I should like to expatiate briefly upon these ideas, and, as I have no authority to speak for other counties, I will confine my remarks to Essex.

² Abstracted in the last part of the *ESSEX NATURALIST* *ante* pp. 123-6.

In Essex considerable changes in the flora and fauna may be anticipated in consequence of rapid extension of building, the cutting down of woods and hedges, alterations on the coast brought about by the draining and cultivation of salt marshes and the silting up of estuaries, &c. Dr. Sorby has described the changes in the shallow-water fauna of the coast during the last fourteen or sixteen years. Inland and near the towns, the destruction of raptorial birds and mammalia by gamekeepers and the increase of insectivorous birds consequent upon the enforcement of the Wild Birds Acts, are causes which apparently determine the disappearance of many insects and mollusca which is so regrettable. These are strong reasons for the preparation of more detailed floral and faunal catalogues than any yet produced, of the character which I understand Dr. Smith and Mr. Rankin will advocate in their paper. If such work is not done soon it will be too late, as the rapid changes of environment and food will exterminate some species and modify the habits of others. And I would emphasize the importance of our local museums being furnished with extensive and accurately localised sets of plants, animals, and fossils before destructive influences have blotted out for ever many rare forms and variations. The sea has washed away a great part of our fragment of Waltonian Crag, and the builder has covered up or carted away our river-terraces and brick-earth deposits.

This scientific collecting and registration, if done systematically and thoroughly, will need not only much careful work, but also the expenditure of considerable sums of money.

The desirability of carefully registering and systematically exploring the prehistoric remains in Essex has engaged our attention for many years past. As long ago as 1883 our Vice-President, Professor Meldola, F.R.S., read a paper before this Conference on "Local Societies and the Minor Prehistoric Remains of Britain." The paper was printed *in extenso* in the *Transactions of the Essex Field Club* vol. iv. pp. 116-122. The destruction of some of these remains, and the precarious tenure of existence of such as remain, have often been the subject of remark, as in the noteworthy address of Mr. Read referred to above. I am very glad to say that the suggestions of these gentlemen with regard to cataloguing and mapping these interesting relics is now being carried out in Essex. Our

Vice-President, Mr. Chalkley Gould, has prepared for the first volume of the *Victoria History of Essex* a very complete list of them, accompanied by a map. But a catalogue, however excellent, is only a preliminary step. Accurate plotting down, on large scale plans, of the outlines, geographical positions and elevation of these works, and their careful scientific exploration so as to determine their probable periods and motives, still remain to be undertaken. I venture to submit that this is work which must be done by local Societies if it is to be done at all. Great London associations may undertake the "reconstruction" of Silchester; a fortunate county may possess a Pitt-Rivers to plan and munificently carry out archæological explorations; we may find the study of the physical and life-conditions of the North Sea becoming a matter of Government and international importance. But the patient tasks of collecting and registering plants, animals, and fossils, and the examination of minor earth-works, camps, red-hills, deneholes, &c., should be the duty and pleasure of local enthusiasts.

The councils and officers of many of our local societies hardly need committees of the British Association to indicate these lines of activity. They have been fully alive to them ever since their societies were called into existence. But, as we in the Essex Field Club know full well, such work is very costly, and in most cases needs funds quite in excess of the slender balances at our bankers. We have the will, but we lack the means. And this is the position with very many of our local societies.

Is there any escape from this difficulty? I think it can be shown that there is a way out.

Everyone knows that our county councils have very considerable annual sums entrusted to them for purposes summed up in the very elastic phrase "technical instruction." This is in addition to any rate for primary or secondary education. The allocation of this technical education money is in the hands of committees of the councils, subject to some sort of revision by the Board of Education. The annual income from this source in Essex is considerably over £20,000.

My proposal is that the Education Committee of each county in which a recognised scientific Society exists should be asked to allocate a small annual sum (say from £100 to £200) for the

purposes alluded to, in accordance with some such scheme as the following :—

1. That the local Society should in each year lay before the Education Committee of the County Council proposals and plans for any explorations or investigations which in the opinion of the expert committee of the Society, are worthy of being undertaken, and that on approval the estimated sum required for the work and for the publication of the report be allocated to the Society.

2. The committee of the Society having accomplished the work, should prepare a detailed report, with such maps and illustrations as may be necessary. This report might be printed in the journal of the Society, copies being struck off for sale. Or the reports might be issued on a uniform plan for the whole kingdom. In any case the reports should be issued at a very cheap rate for distribution to the public.

3. Any sum unexpended might be returned to the council, or carried to the next year's work.

4. In selecting the subjects proper for such a series of investigations the peculiar conditions and requirements of each county will be considered. Taking Essex as an example, the following may be suggested :—

(a) The accurate surveying and plotting down on large-scale plans of typical prehistoric remains, particularly of such as may be in danger of destruction, and the careful exploration of the same under expert direction.

(b) The preparation of accurate lists and of maps of the county, showing the positions and mode of occurrence of any relics of prehistoric age hitherto found therein, with indications of the museums or collections in which they are preserved, and references to any published details and figures.

(c) Exploration work in the shallow-water districts of the North Sea and in our estuaries and rivers, so as to collect materials for full and accurate lists of the marine and fresh-water fauna and flora, and to study the conditions regulating the occurrence of each form where possible.

(d) The mapping out of the distribution of inland plants and animals, having like regard to the conditions of their occurrence ; the study of the varying conditions of agriculture and gardening in different parts of the county.

(e) The exploration of interesting geological deposits, so as to accumulate, before they disappear, as perfect sets as possible of characteristic fossils. Examples : our Walton Crag, brick-earths and terrace gravels.

(f) The study and registration on large-scale maps of coast erosion and the formation of sandbanks and the silting up of our estuaries.

(g) Any special investigations which may be suggested by the County Council itself, or by the British Association Committee.

5. All specimens, plans, &c., thus obtained or made should be deposited in the county museum, the museum authorities undertaking to suitably preserve and register them for future study.

6. As above indicated, all the reports should be published at a cheap rate, and copies deposited in local libraries and in the principal public libraries in the kingdom. The British Association might well be asked to catalogue these reports from the several counties as an Appendix to the Report of the Local Societies Committee.

Such is a rough sketch of my proposal. I have assumed that a county scientific Society exists in each county. Where this is not the case, a joint committee of the smaller Societies of the county might be formed for this business. I may be permitted to observe that, in my humble opinion, it is most desirable that such Societies should at once unite to form strong county units. Each county should have *one* scientific Society and *one* archæological Association, with local sub-committees, if thought necessary.

The primary difficulties are left until the last. Would our county councils consider the subjects mentioned and the suggested method of treating them of educational value? If so, would they assist? and, finally, Is such an allocation of educational funds legal?

It is submitted that the small annual sum mentioned would, if expended in this way, produce results of considerable educational value. We spend vast sums in teaching modern history, and ought we to consider the "buried history of Britain" (as it has been happily termed) of no importance? The work of collecting information respecting plants, animals, fossils, encouraged and

directed by the local committees, would certainly be of direct educational value to all taking part in it; and the reports, when issued, would be admirable object-lessons, serving to show how much of interest our own counties possess. And now that the importance of museums in education is recognised by scores of thoughtful writers and speakers, would not the sets of specimens, accurately named, localised and described, be of real use to students and investigators? Of the scientific importance of the results from the work advocated it is unnecessary to speak before this Committee. And we must not forget that there is a strong feeling of local patriotism, which appeals to all.

Of the legal aspect of the question I am not qualified to speak; the problem might be submitted in the first instance to the Board of Education. Should it be found that the present law would not permit of such allocation of funds, it might not be difficult to induce the Government to introduce a two-line clause into some "omnibus" Educational Bill (there are sure to be a few in the near future) permitting the county councils to act as indicated above.

It is suggested, if the proposals meet with the approval of the Scientific Societies Committee, that a small sub-committee be appointed, to meet in London and consider the steps that may be necessary to bring the matter before the public and the authorities. Perhaps the British Association itself would aid in bringing the matter prominently before those in authority and the public generally, and it might not be difficult to enlist the sympathies and co-operation of a few Members of Parliament favourable to scientific education, supposing any parliamentary action is necessary.

I should like to see some active, practical steps taken; in my opinion, the local Scientific Societies Committee could not confer a greater benefit on the Societies, nor aid more the progress and study of natural science and archæology in the counties by the numerous amateurs now existing, than in promoting some such scheme as that I have advocated.

[This little paper is printed as originally written, but in reply to some recent criticisms I may say that in putting archæological investigation in front of the list of suggested subjects I was simply following recommendations that had been made by some distinguished men at former meetings of the British Association

Committee. I am aware that such subjects as those grouped under (c) and (d) might be considered as more "practical" and more worthy of public support. But it may be anticipated that in the event of these county investigation committees being established, subscriptions in aid of "unpractical" investigations would come in, just as the Field Club has on several occasions raised considerable sums for camp and denehole explorations. Interest in the work would grow, and the established county committees would quickly gather up and enfold scattered energies in aid of their systematic labours.

I cannot refrain from expressing disappointment at the somewhat colourless "recommendation" arrived at by the Corresponding Societies Committee after consideration of the proposal. In all patience we have had enough of barren "recommendations" and "resolutions," for a dozen years past. The plea now is for a practical working scheme, and I hope that some effort will be made to band together the county scientific societies to attempt a realization of some such plans as that outlined above. Our quiet country scientists are too apt to forget that they have votes and a personal interest in good education equally with more outspoken folk; they should not be too timid to accept Sir Norman Lockyer's advice, and become judiciously "political." Well-timed pleading might induce candidates for county work and honours to give heed to the claims of science in the disposition of the large sums now available for higher education. The disingenuous cry of "save the rates" sometimes raised against analogous suggestions is not applicable to the trifling grants asked for; these sums are almost infinitesimal compared with claims put forward on behalf of subjects of at least not greater "practical" and educational importance than some that I have indicated.]

SOUTH ESSEX BRAMBLES.

By C. E. BRITTON.

DURING the latter part of the summer of 1903, I visited Warley Common and neighbourhood on two occasions for the purpose of collecting and observing brambles, and paid one similar visit to Danbury Common. Examples of all the various kinds of brambles gathered on these occasions, were included in the very large packet of *Rubus* specimens, which I sent during the autumn to the Rev. W. Moyle Rogers, F.L.S. for examination. I am very much indebted to him for his great kindness in confirming my suggested names for some, and in furnishing names for others that were beyond me, and I am further indebted to him for the information that the following species and varieties of *Rubus* are "new records" for the Watsonian Vice-county, 18 South Essex:—*Rubus nitidus* Wh. and N.; *R. imbricatus*, Hort var. *londinensis* Rogers; *R. carpinifolius*, Wh. and N.; *R. dumnoniensis*, Bab.; *R. pubescens* Weihe, var. *subinermis*, Rogers; *R. anglicanus*, Rogers; *R. fuscus*, Wh. and N. var. *nutans*, Rogers; *R. adornatus*, P. J. Muell; *R. dumetorum*, Wh. and N. var. *britannicus* (Rogers); *R. balfourianus*, Blox.

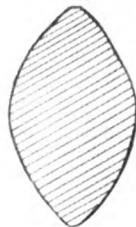
In the following lists an asterisk denotes that a dried specimen of the plant in question from the locality mentioned has been seen by Mr. Rogers.

Warley Common: *Rubus idæus*, L., *R. lindleianus*,* Lees; *R. rhamnifolius* Wh. & N.; *R. pulcherrimus*,* Neum.; *R. selmeri* Lindeb.; *R. rusticanus* Merc.; *R. pubescens* Weihe var. *subinermis** Rogers (also at Childerditch*); *R. sprengelii** Weihe. Besides the usual pink-flowered form of this, there also occurs at Warley Common, a form* with white flowers which Mr. Rogers notes is a rare one. *R. pyramidalis** Kalt.; *R. leucostachys* Schleich.; *R. anglicanus** Rogers; ("a form one step towards type *R. radula* Weihe," Rogers); *R. fuscus* Wh. and N. var. *nutans** Rogers; *R. foliosus** Wh. and N.; *R. infecundus** Rogers (also at Great Warley Street*); *R. dumetorum*, Wh. and N.; *R. balfourianus*,* Blox.

On *Tylers Common* very few kinds of brambles grow. *Rubus rusticanus* Merc. and *R. dumetorum* Wh. and N. are plentiful,

and very sparingly, *R. dumnoniensis*, Bab. *forma*. This latter plant differs somewhat from the usual British form of this species. It is a beautiful plant with a roundish, deeply cordate terminal leaflet and bright pink flowers (in the type the flowers are milk-white). Mr Rogers remarks that it is almost identical with a form found growing by him in the Channel Islands at Sark and Guernsey. Other brambles seen in this neighbourhood were : *R. rhamnifolius** Wh. and N., *R. leucostachys*, Schleich, and *R. leucostachys* × *rusticanus** in profusion, the hybrid parentage of this being very well marked. *Rubus fuscus* Wh. and N. var. *nutans** Rogers, *R. foliosus* Wh. and N., and *R. rhamnifolius* Wh. and N., grow on Coombe Green Common. *R. cæsius*, L., near Upminster Station ; *R. cæsius* × *rusticanus** towards Tylers Common ; and along the same road *R. corylifolius*, Sm. var. *cyclophyllus* (Lindeb.) The most abundant brambles on Warley Common are *R. selmeri*, Lindeb., and a form (or forms) which seems to connect *R. nitidus* Wh. and N., with *R. affinis* Wh. and N., var. *briggsianus* Rogers, and, perhaps, *R. lentiginosus* Lees. Further study is required here, as this Warley Common form may cause the plant known as *R. affinis* Wh. and N. var. *briggsianus*, Rogers, to be associated with *R. nitidus* Wh. and N., rather than with *R. affinis* Wh. and N. ; a result that would be in accordance with the views of Dr. Focke.

Danbury Common : *R. idæus*, L., *R. nitidus*,* Wh. and N., *R. imbricatus* Hort. var. *londinensis** Rogers. This is identical with the plant growing on the commons on the south-western and south-eastern outskirts of the Metropolis, and distinguished as a new variety in the *Journal of Botany*, March, 1903. It is apparently very rare at Danbury. *R. carpinifolius** Wh. and N. (this also seems a rarity here), *R. rhamnifolius*, Wh. and N., *R. pulcherrimus*, Neum., *R. selmeri* Lindeb. (by the road from Bicknacre) ; *R. rhombifolius*,* Weihe. A form or variety of this species growing abundantly here is very similar to a Surrey plant found by Major Wolley Dod, which seems sufficiently distinct from the type to be regarded as an undescribed variety. Further study is desirable. *R. rusticanus* Merc., *R. sprengelii** Weihe, *R. pyramidalis*,* Kalt. (a small form identical with the Warley Common plant. A highly glandular form* grows by the road from Bicknacre). *R.*



$\frac{1}{2}$

POLISHED CELT FROM DODDINGHURST, ESSEX.
One-half actual size.

leucostachys, Schleich, *R. leucostachys* × *rusticanus* is plentiful in one place at least, and sterile. *R. echinatus*, Lindl., *R. foliosus*, Wh. and N., *R. infecundus*, Rogers, *R. adornatus*,* P. J. Muell (by the road from Bicknacre); *R. hystrix** Wh. and N., *R. dumetorum*, Wh. and N., *R. corylifolius*, Sm. var. *sublustris* (Lees); *R. balfourianus*, Blox. (roadside hedges by the Common).

Besides these, I gathered at Danbury Common examples of several brambles which require further study another season.

ON A POLISHED STONE AXE FROM DODDINGHURST, ESSEX.

By F. W. READER.

THE discovery of this implement, which is here represented (*Plate VII.*) is due to Miss Rosa Woltorton, a teacher in the school at Doddington, who found it in her garden. The form of the stone appeared to Miss Woltorton to be unusual, and she placed it as a curiosity on the window sill, but without understanding the nature of her discovery. It was, however, recognised by the Rector, the Rev. F. A. Adams, when visiting the house, and was by him brought to public notice.

It is a regularly polished axe of mottled flint, ochreous stained, of the type most usually found in East Anglia, having a pointed oval section, the sides being very slightly ground. The cutting edge bears marks of use. It has also received much subsequent rough usage, the butt-end having quite disappeared, while a large portion is missing from the cutting edge. These fractures are evidently later than the use of the implement and are not ochreous stained. Most of these later fractures are, however, not very recent, being variously weathered and patinated.

The present length of the implement is 7 inches, its greatest width 2½ inches.

NOTES ON REPORT OF THE ESSEX BIRD PROTECTION SOCIETY, 1903.

By FRANCIS DENT, *Hon. Sec. to the Society.*

[*Read December 19th, 1903.*]

IN spite of the constantly increasing work thrown upon it by Parliament, the Essex County Council still finds time to devote its attention, amongst other objects, to the Protection of Wild Birds. The latest of several orders in Council made by the Home Secretary, varying and extending the provisions of the Wild Birds Protection Act, 1880, for the County of Essex, is dated Dec. 13, 1901, and is summarised in the Report for 1903, which has just been issued by the Essex Bird Protection Society. This Society, which was originally formed for the purpose of calling attention to the necessity of further protection for some of our rarer wild birds which were in danger of extinction, continues to do useful work in helping to make the Protection Order really effective, by employing watchers at various stations along the coast, to see that the law is observed, by stimulating the zeal of the County Police by giving small rewards in cases where extra vigilance has been shown, and by itself undertaking to prosecute offenders against whom proceedings would not otherwise be taken in such cases as are brought to its notice.

From the summary of the Protection Order given in the report, it will be seen that two separate areas in the County are specially protected (1) The coast and estuaries, and (2) the suburban parishes which border upon Epping Forest.

The Essex coast with its network of creeks, saltings and marshes from Harwich to Shoeburyness forms a natural breeding ground for a number of birds, among which are included black-headed gulls, terns, lesser terns, ring plover, redshank, peewit, sheld-duck, wild duck, teal, pochard, besides many others, and is the haunt in winter of large numbers of wild fowl. When the County Council took up the question of Protection, some of these species were on the verge of extinction, as breeding species at any rate. The terns, and lesser terns in particular, had suffered great diminution by the robbing of their nests, which

are only too easily found, and from the indiscriminate shooting of the young birds just on the wing by the cockney sportsmen shooting from boats at the beginning of August. By the extension of the close season to August 15, the young birds and flappers have the advantage of an extra fortnight, which enables them to get fairly strong on the wing before shooting commences, and the total prohibition of Sunday shooting along the coast gives them a further chance. All eggs are now also protected along the coast, and here the Bird Protection Society is fortunate in securing for a small fee the services of 11 persons, mostly fishery inspectors, whose duties and avocations take them constantly about the coast, who kindly undertake to act as watchers to see that the provisions of the Order are enforced, and to report offences.

From the reports made by these watchers, extracts from which are given in the Society's annual report, it will be seen that a distinct increase is to be noted in the numbers of shore breeding birds, and that the provisions of the Protection Order are now fairly well observed. Blackheaded gulls perhaps show the greatest increase, and several new gulleries have been formed ; terns breed regularly still in one or two places, and will it is to be hoped, hold their own ; that beautiful bird the lesser tern breeds in at least one place and the colony which a few years ago was all but extinct is now thriving and on the increase. Redshank and plover abound and ring plover are common enough on the shingle. There are few pleasanter places on a summer's day for an ornithologist than the marshes and sandhills when the saltings are all flushed with thrift, and the air is full of the cries of the blackheaded gulls or terns, redshanks and plover.

In the south-western part of the County, Epping Forest, with its 6,000 acres, more or less, of woodland and plain, provides a sanctuary for quite a different class of birds, but in its way quite as interesting. To this 6,000 acres must now be added the 800 acres of Hainault, on the east of the Roding Valley. Here the protection of birds is looked after by the keepers, under the bye-laws made for the regulation of the Forest, but the lanes and waste strips of the adjoining parishes until lately were the hunting-ground of swarms of East-End bird-catchers. The Protection Order now extends the close time for certain wild

birds to the whole year in such parishes as are within the Metropolitan Police Area, and also protects the eggs of certain species. In this part of the county the Bird Protection Society do not employ any watcher, but confine themselves to doing what they can to second and stimulate the zeal of the police, who are now generally active in enforcing the law. The President of the Society, Mr. E. N. Buxton, to whose initiative is due the reafforestation of Hainault, has also induced the owners of most, if not all, the estates adjoining the Forest, to extend their protection to certain species of birds, *e.g.*, herons, ducks, kingfishers, magpies, kestrels, and owls, with satisfactory results. Reports from the owners of these estates and from the Forest keepers are received by the Bird Protection Society, and from them it would appear that owls, both barn and tawny, are certainly more numerous than they used to be. Magpies, never common in this district, breed regularly on one or two estates, but the number of nests reported remains about constant. Kestrels would certainly increase, but unfortunately, they often fall a victim to the temptations put in their way by the artificial rearing of pheasants, and so lose the good character they ought to enjoy. It is particularly satisfactory to learn that there appears to be a decided increase in the number of goldfinches, a bird which has, it is to be feared, peculiar attractions for the birdcatcher.

Beyond making the suggestion that goldfinches might, like kingfishers, be protected throughout the county during the whole year, it would appear that the protection afforded to our Essex birds by the Order of 1901, is fairly adequate, and all that is necessary is that the Order should be enforced. It may be suggested, however, that the Order might be somewhat simplified, meanwhile the Essex Bird Protection Society is probably wise in confining itself to working on the lines of the Protection Order and can claim some share in helping to make it effective. Additional interest would be given to its annual reports if those interested in ornithology in the County would send any notes of interest in their district to me as secretary; I am always glad to receive and incorporate any such notes in the reports. (Address : *Loughton, Essex.*)



GREYWITHERS AT GRAYS THURROCK, ESSEX.

Photographed by Messrs. A. R. and W. D. Holmes, 1923.

ON SOME GREYWETHERS AT GRAYS THURROCK, ESSEX.

By T. V. HOLMES, F.G.S., F.Anthrop.Inst., Vice-President, E.F.C.

(With Plate VIII.)

[Read November 28th, 1903.]

THE massive blocks of silicious sandstone known as Greywethers or Sarsen stones, the remains of Tertiary beds of more than one geological horizon, are found irregularly scattered over various parts of the London Tertiary Basin, from Berkshire and Wiltshire to Kent and Essex. Being usually noticeable as masses of hard stone lying on the surface of rocks of various ages from the Chalk upwards, in districts where there is scarcely any building stone, it is not surprising to find that in primitive times these blocks were used in the construction of rude stone monuments like Kit's Coty, near Maidstone, Stonehenge and Avebury. At a somewhat later period the name Sarsen (Saracen) stones implies a popular belief in their diabolical, or at least pagan, origin, use or distribution. For a thousand years ago the words pagan, or heathen, and diabolical meant to the mass of people much the same thing. Indeed in the well-known lines of Burns, written towards the end of the eighteenth century, we get the then popular identification of the devil with the author of the best-known form of heathenism thus pithily expressed :—

“ The De'il cam fiddling thro' the toun,
And danc'd awa' wi' the Exciseman ;
And ilka wife cries, Auld Mahoun,
I wish you luck of the prize, man ! ”

The name Greywethers, on the other hand, simply notes the resemblance of these blocks to a flock of sheep, when they are numerous and close together, and are seen from some distance.

Where they are abundant they have been prized as yielding very hard and durable building-stone for structures of much later date than Stonehenge or Avebury; Windsor Castle, for instance, being largely built of the material they afford¹. Thus where numerous on the surface of a district, they tend to disappear in proportion to the rate of progress in agriculture and building there, and to remain undisturbed and undestroyed only in wild uncultivated spots. As they are the sole remains of

¹ Whitaker, *Geology of the London Basin* p. 390, Lond. 1872.

Tertiary beds the softer portions of which have been removed by denudation from the places where these blocks are now seen, and as their distribution is extremely irregular, their occurrence, when seen, is well worth noting from a geological point of view.

But greywethers are not necessarily to be seen only on the surface of a district. Mr. Whitaker remarks that they "occur somewhat rarely in our River Gravel."¹ For the changes in the courses of rivers occasionally involve the imbedding in river deposits of blocks once some little distance from the banks of the stream. At an excursion of the Geologists' Association to the British Museum of Natural History on March 15th, 1902 (*Proc. Geol. Assoc.*, vol. xvii., pp. 365-6) the members inspected a large Sarsen stone discovered in Thames Gravel when the foundations of the Victoria and Albert Museum were being excavated. It was presented to the N. H. Museum by Colonel C. K. Bushe, F.G.S., a member of the Association, who saw it taken out. It is now in the Eastern Gardens of the Museum.

In the *Geological Magazine* for 1867 there is a very short paper by the late Professor John Morris, once a much esteemed honorary member of the Essex Field Club, "On the Occurrence of Grey-Wethers at Grays, Essex." It occupies little more than a page (pp. 63-4). He remarks that the occurrence of Sarsen stones "has not, I believe, been generally noticed in this locality." The various chalk, &c., pits, when he wrote, had not been worked so far back northward as they now are by a considerable distance. He states that "the Sarsen stones (of which some may be still seen lying about the large chalk pit) I have noticed during the progress of the workings as occurring on the upper surface of a bed of disturbed chalk, above the solid chalk, and covered by a blackish, or carbonaceous clay containing fresh water shells. They are of various sizes, some very large, and more or less waterworn."

He adds that the position of the Sarsen stones seen by him was "about midway between the back of the present workings and the entrance to the pit." The grey wethers were evidently in old river deposits, though it is not now easy even to identify the exact pit of which Prof. Morris writes. But as the spot

¹ *Geology of London and of part of the Thames Valley*, vol. i., p. 330.

where he saw the greywethers was about midway between the northern and southern ends of the pit, it was in all probability

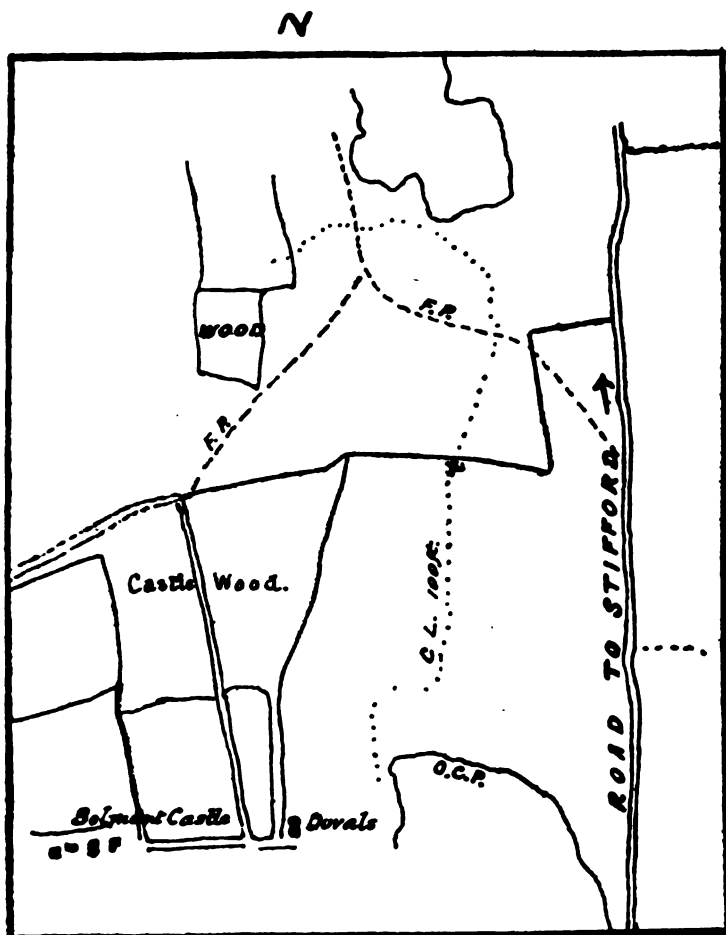


FIG. 1.—MAP. SCALE 6 INCHES = 1 MILE.

O.C.P., Boundary of Chalk, &c., Pit, when the Map was made; F.P., Footpath;
C.L., Contour Line; X., Position of Greywethers.

some hundreds of yards southward of the spot at which I saw some grey wethers in March and April, 1903.

The position of those seen by me is shown on the map accompanying these remarks, which is from the ordnance map

of 6in. to a mile. The pit is that east of "Duvals," and west of the road from Grays to Stifford, and the mark indicating the position of the grey wethers also shows the most northerly point now attained by the pit. For some yards southward, however, the excavation extends downwards only to the level of the top of the chalk. The height of the section shown in my drawing is about 17ft. from the green-coated flints at the top of the chalk to the surface. Above the green-coated flints are about 8ft. of Thanet sand, and above the Thanet sand are old Thames river deposits, gravelly towards their base and sandy

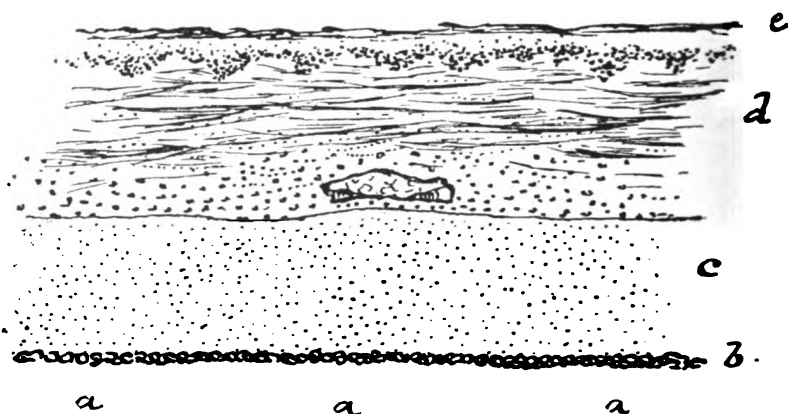


FIG. 2.—*a* TOP OF CHALK ; *b* GREEN-COATED FLINTS ; *c* THANET SAND ;
d OLD RIVER DEPOSITS ; *e* SURFACE.

Height of Section, about 17 feet.

above, both much current-bedded. Then, nearer the surface, is another irregular bed of small pebbles, and above the pebbles a little sand and soil. The greywether shown in place is close to the bottom of the river deposits. Another was seen in a similar position a few yards eastward, and a third and smaller one a few yards westward, in the band of small pebbles, about 2ft. from the surface. Eight or nine other blocks of various sizes were lying a few yards southward of the greywethers shown in place, having been extracted by the workmen during the progress of the excavation northward.

I am indebted to my sons, A. R. Holmes and W. D. Holmes for the photographs showing the block in place in the section,

(Fig. 3) and some of the blocks near it, which have been removed from their original positions (*Plate VIII.*) The curious waterworn appearance presented by some of the sides of these blocks is better shown in photographs than by drawings. The photograph of the section does not quite include the surface line, though the irregular pebble bed from two to three feet below it is seen. In the case of a section in soft strata like this, which is certain speedily to become obscure, and which may wholly disappear,

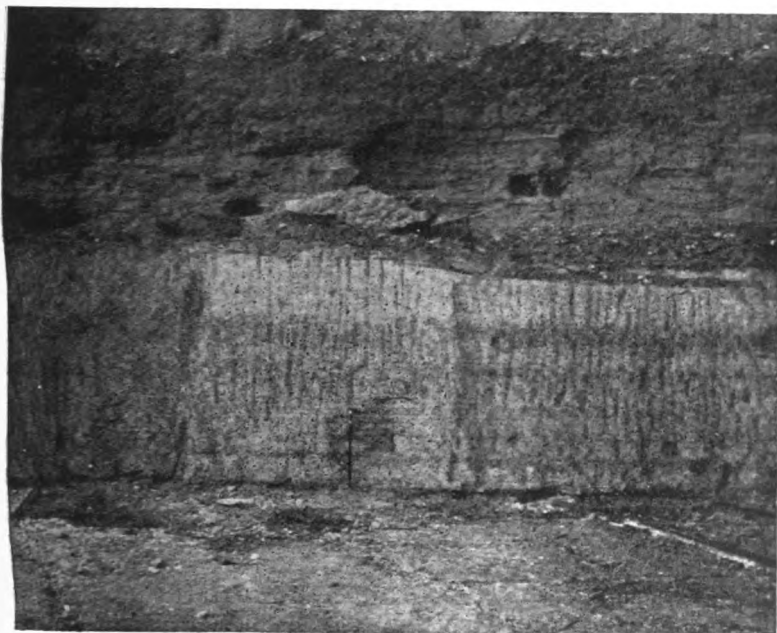


FIG. 3.—GREYWETHERS IN PLACE IN CHALK-PIT AT GRAYS, ESSEX, 1903.

and of greywethers likely to be broken up for building purposes or road-metal, photographs seem to be specially desirable.

Among the greywethers scattered about in front of the section were some which had in them a few very small flint pebbles, not larger than hazel nuts. But in no case, among those seen, were the little pebbles in such abundance as to suggest that the blocks should be classed with the "pudding-stone" conglomerate rather than the greywether division of the

hard Tertiary stones. Mr. Whitaker (*Geol. London, etc.*, pp. 478-80) has some remarks on "Greywethers and Pudding Stones," in which he discusses the distribution and probable origin of both. He agrees with Professor Prestwich in thinking that they have been largely derived from the Woolwich and Reading Beds; though at the western end of the London Basin, where they are most numerous, "the origin of the greywethers may be traced to the Bagshot Sands." At Grays it seems most probable that the greywethers have been derived from the Woolwich and Reading Beds, which occupy a considerable area at the surface between Stanford-le-Hope and Wennington, and were once continuous with the beds of the same age on the Kentish shore opposite. Between Orsett and Stifford, and thence towards Aveley, they occupy much less of the surface than between Orsett and Stanford-le-Hope. But this results mainly from the fact that from Orsett westward their outcrop is much more largely hidden by the Old Thames river deposits than from Orsett eastward. And in these old river deposits, formed when the Thames was flowing about 100 feet above its present level, the Grays greywethers were seen.

It is curious to note in the section at Grays showing these greywethers in place, the absence of any signs of disturbance caused by the entrance of these weighty masses of stone into the fine gravel and sand. During the gradual changes in the position of the channel of the old Thames these blocks seem to have been deposited in it most gently and gradually, having travelled but a few yards from the place at which they were originally formed. A stream bringing down to a certain part of its course, in time of flood, a debris of tree trunks with other organic remains mixed with gravel and sand would show a much more disorderly channel section in later times, from the perishable nature of much of the material, than would be afforded by the gradual letting-down of some weighty but almost indestructible greywethers in the same place.

NOTES—ORIGINAL AND SELECTED.

ZOOLOGY.

MAMMALIA.

Serotine Bat at Laindon Hills.—A specimen of *Vesperugo serotinus* was obtained on July 4th, 1900, at Laindon Hills. It was injured, but still alive when I procured it from a man in the parish. How he came by it I do not know. I am obliged to Dr. Laver for confirming my identification of the bat.—Rev. A. BERTRAM HUTTON, The Rectory, Pitsea, December 12th, 1903.

[Dr. Laver says in his *Mammals, etc., of Essex*, that this is a very rare species in Essex. The only two specimens hitherto recorded are those by Mr. Miller Christy at Saling (*Proc., E.F.C. iv. p. iv.*) and Broomfield (*E.N. viii., 162*). According to Sir Harry Johnston (*British Mammals*, London, 1903), the serotine is confined in the British Isles to a small portion of the south of England between Cornwall and Essex. "Outside England its range is so world-wide as to exceed that of any other bat, for it is found all over temperate Europe, Asia, and North America, also in North Africa, and even, it is said, in parts of South America." The Essex occurrences are interesting, as Dr. Laver observes, because they are the most northerly ones hitherto recorded.—ED.]

Badgers at Mucking.—It may be worthy of record that I have a specimen of the badger shot at Mucking in the summer of 1902. It had been buried, but in spite of the time being August, I exhumed it three days after interment, and succeeded in preparing the skin in good condition, aided in the unpleasant task by a younger brother. I have taken a photograph of the holt in which the animal occurred. I am assured that four (even perhaps six) badgers were seen in this holt.—Rev. A. BERTRAM HUTTON, The Rectory, Pitsea, December 12th, 1903.

Otter at Canvey Island.—I have obtained for my collection of mammalia an otter, killed on Canvey Island. I am told that the otter so injured a dog that the latter died in a few days. The otter sat up as though about to spring again, when the man who was with the dog killed it by a blow on the head with a stick.—Rev. A. BERTRAM HUTTON.

Hairless Specimens of the Brown Rat at Leyton.—Mr. G. A. Doubleday writes as follows to the *Zoologist* :—

“ At the scientific meeting of the Zoological Society of London at Hancver Square, on December 1st, Mr. F. E. Beddard exhibited, on my behalf, a hairless specimen of the Common Rat (*Mus decumanus*) which had been captured at Leyton, Essex. Two other exactly similar individuals had been caught, and others, in the same condition of nakedness, had been observed at the same place. The skin was of a slate colour, and wrinkled into folds all over the body. No cause was assigned for the peculiar condition of the animal, some of the members present being of opinion that it was congenital, and others that it was pathological.”

[The late Dr. Bree recorded in the *Field* (Oct. 5th, 1872, p. 328) the capture of two hairless rats at Thorpe-le-Soken, Essex. The specimens were sent to the museum of the Royal College of Surgeons.]

The Diffusion of Arctic Mammalia.—The following paragraph appears in the *Times* of December 19th, 1903 :—

“ *Polar Bears Adrift on an Iceberg.*—The Cunard steamer Campania, from New York, which arrived at Queenstown yesterday afternoon, brings intelligence that during the last outward passage of the Transatlantic liner Hanover, for Baltimore, and when the steamer was in latitude 44 54 N., longitude 48 29 W., crossing the banks of Newfoundland, a very large iceberg was sighted, the contour lines of which, as seen from the liner, were high, but very irregular. The passengers all gathered on the starboard side of the vessel, to view the iceberg, and telescopes were brought into requisition to get a better view of it. Members of the crew of the Hanover were the first to discover that on the huge berg several Polar bears were walking about, but, as the liner got more abreast of the iceberg, all on board saw with the naked eye six bears moving restlessly upon it. How the animals got there and their probable fate was the sole topic of conversation among the passengers during that day. Captain Jacobs, of the Hanover, stated that the berg was drifting in a S.S.E. direction.”

Most students of geology might allow the agency of icebergs, as a means of the southward diffusion of Arctic mammalia, as a barely possible influence. Few would regard it as of any practical importance. Yet here we have an authentic account of the discovery of six living Polar bears on an iceberg in a latitude which is not that of Essex but of southern France.—T. V. H.

BIRDS.

Occurrence of the Osprey in Essex.—Mr. H. C. Tower writes from Weald Hall, Brentwood, to Mr. Miller Christy, as follows :—

An Osprey (*Pandion haliaetus*) appeared last year and stopped in this Park from Sunday, Oct. 11, till Saturday, the 24th of the same month. It was last seen at 10 a.m. on that day.

When it first came it was very tame, coming and taking some gold-fish out of a pond in the garden where some gardeners were working. Afterwards, it generally took up a position on the dead bough of a tree on an island in the Big Lake, where it was occasionally mobbed by rooks, for whom, however, it appeared to have a supreme contempt.

There is absolutely no doubt about its identity, as both my father and brother saw it frequently with the naked eye and also through a telescope.

It was, of course, protected, and notice was given round about, so that it should not be shot.

INSECTS.

The "Painted Lady Butterfly."—Continuing the notes on the remarkable apparition of *Cynthia cardui* on our coasts last autumn (*ante* pp. 129-131) it will be interesting to quote a few paragraphs from an excellent paper by the well-known natural history artist, Mr. F. W. Frohawk, F.E.S., in the *Field* for November 14th :—

"Until recent years, the sudden appearance of this beautiful butterfly in extraordinary abundance in certain seasons puzzled the best of observers. The older writers on entomology were quite at a loss to account for the erratic habits of the Painted Lady (*Cynthia cardui*) and some other migratory species, such as the Clouded Yellow (*Colias edusa*), the Pale Clouded Yellow (*C. hyale*), the Queen of Spain Fritillary (*Argynnis lathonia*), the Chequered White (*Pieris daplidice*), and the Camberwell Beauty (*Vanessa antiopa*). The occurrence of all these butterflies in this country is due to immigration; although they are common continental species occurring on the opposite coasts of France, yet the English winter climate is apparently wholly unsuitable for their existence."

After sketching the life-history of the insect Mr. Frohawk continues :—

"Frequently years pass without hardly a specimen being seen, but then may come a year, such as the present season, when a sudden and vast invasion takes place, arriving in hundreds of thousands along our shores, and dispersing themselves throughout the country, and great numbers find their way to Ireland,

where in such years they are met with all over the island. At the present time this great migratory flight has, according to the reports already received, extended from the Shetlands to the southern-most part of England; swarms have appeared along the whole of the eastern seaboard, from Durham to Kent, and large numbers have been recorded from the Scotch coast; it is therefore probable that they extended in an almost unbroken line along the entire eastern coast of the British Isles. Apparently this great swarm of butterflies reached our islands from the Continent about September 20. On that date at mid-day large numbers suddenly made their appearance at Hockley, Essex, a few miles inland, where I found them over two patches of Devils-bit Scabious (*Scabiosa succisa*) busy feeding on the blossoms in company with its near ally the Red Admiral (*Vanessa atalanta*), the Peacock (*V. io*), the Brimstone (*Gonopteryx rhamni*), numbers of Meadow-Browns (*Epinephle ianira*), Small-Heaths (*Cænonympha pamphilus*), Small Coppers (*Chrysophanus phlaeas*), Common-Blues (*Lycæna icarus*), the three Common-Whites (*Pieris napi*, *P. rapæ*, *P. brassica*), and innumerable Silver-Y moths (*Plusia gamma*), which is usually exceedingly abundant in a *cardui* year, it being a migratory species. Altogether this great gathering of insects formed a charming scene, but on September 24 and 25 the same patches of scabious were literally swarming with *cardui*. They were in such profusion that it was an easy matter to capture as many as five or six with one sweep of the net. It was a wonderful sight to see so many of these beautiful butterflies floating over and settled on the purple flowers of the scabious; the colouring of both flowers and insects formed a rich and delicate harmony. I captured several dozen of the finest specimens, and upon comparing them with a bred series, I find many are almost equal to the latter, having every appearance of being but freshly emerged, and bear no trace of having undergone a journey over the sea. Obviously, they are the progeny of early summer immigrants. I noticed a few in June and in the early part of July which were faded and worn. The majority of the swarm showed in a more or less degree evidence of having been some time on the wing, and were undoubtedly immigrants."

"It is a remarkable fact that the last great "*Cardui* year" was hitherto the wettest season on record, that of 1879. In that year vast swarms occurred all over Europe, and were the topic of the various newspapers. According to the reports gathered and published in the entomological journals, it appears that the first migratory swarm was observed in North Africa about the middle of April; at Barcelona and Valencia enormous numbers appeared during the last four days of April, and reached the island of Minorca on the first three days of May. Vast swarms passed over Sèvres on June 15, flying all day long in a N.N.W. direction. From June 3 to 9 similar flights were seen at Strasburg passing in innumerable numbers towards the north. On June 10 at Angers an immense swarm passed over part of the city, flying so low that pedestrians were inconvenienced by them, and it was estimated that between 40,000 and 50,000 passed along a single street in one hour. The same phenomenon was observed at Bisheim on June 8, and their enormous numbers darkened the day. So great was the vastness of a flight on June 11 which passed over Steyer in Austria, that between one and two o'clock p.m., ninety to 100 per minute were counted in a breadth of 100 paces, the swarm being estimated above 1,000,000; at other places similar swarms were seen, and so dense at times that the sun was obscured. On June 14 Wetzikon,

Canton Zurich, was invaded by an immense swarm of butterflies, principally *C. cardui*, over half a mile wide, and the procession was so long that it took two hours to pass; they flew from 3ft. to 12ft. above the ground, and went in a north-westerly direction."

"Previous to the great "*Cardui* year" of 1879 an extraordinary flight of these butterflies passed over the island of Vido, of the Ionian group, in 1872; the swarm reached the island about 9 a.m., and continued passing for over three hours. Traces of the flight were evident in the channel of Corfu, as large numbers of butterflies were seen floating on the surface of the water, and for some days after they were seen drifting into the bays of the island of Corfu. As long ago as 1828 the migratory habits of this butterfly were recorded, as in that year an account is given in the *Annales des Sciences Naturelles* of an extraordinary swarm which was seen in the month of May in one of the cantons of Switzerland, their numbers were so enormous that they occupied several hours in passing over the district where they were observed."

"I have just received a letter from my friend Mr. Alpheraky, the experienced Russian zoologist, containing such interesting remarks concerning the occurrence of *C. cardui* in Russia that I take the opportunity of quoting his observations. He says: 'I have inhabited a country (Taganrog on the Azoff) where it is by far the commonest butterfly I know of. Every year I have seen it in great quantities, but in exceptional years I have seen such extraordinary swarms of this butterfly that, except perhaps in some valleys of the Tian-chain mountains, I have never seen anything comparable to the millions of millions of *C. cardui* near Taganrog. The Taganrog type is of a brilliant pinkish colour, such as I have not seen in any other locality, and I remember that my friend Staudinger, the greatest lepidopterists of all times, was quite astonished when I sent him some of the specimens. I have gathered the pupæ whenever I wanted them by hundreds in the space of an hour or so, in any place where *Carduus* or *Cnicus* grew. This butterfly has a very curious habit of following any vehicle that travels fast, for miles, exactly in the manner that porpoises follow a ship, remaining for some minutes behind, then overtaking the horses, and so on. In autumn I have seen them in such numbers on different flowers that I have taken nets full at a time just to see how many I could catch at a stroke, and strange to say all my endeavours to obtain varieties failed. all the specimens have always proved to be typical ones. The type I found in Turkistan is much paler than our Russian one.' "

Mr. Frohawk's article is illustrated by a drawing showing the transformations of the butterfly, done in his inimitable manner, and it is one of the most interesting accounts that has appeared of this visitation.

BOTANY.

Asplenium Ruta-Muraria (the Wall-Rue Fern) in **Essex**.—This plant, though widely distributed over Essex is decidedly rare—at all events as compared with some other counties. In many parts of Sussex, for instance, I have seen it flowering in profusion on almost every old wall.

Gibson, in his *Flora of Essex*, gives, however, one or more localities in each of the eight districts into which he divides the county, with the exception of the eighth—that which comprises Tendring Hundred and the district east of Colchester. For my own part, I have seen the plant now and then, growing in very small quantities on the walls of old churches and the like in various parts of the county. The only place in Essex where, until the present year, I have seen it growing anything more than sparingly, has been on some old brick walls at Purfleet. Only within the last few months have I seen it growing in the county in really large quantities.

In July last I saw the plant growing on the brick walls of several of the Martello Towers near Clacton-on-Sea. On one of these—I think the second to the south of the town—the plant was growing in the greatest profusion. This tower stands within fifty yards of the sea—in fact, almost on the beach. There were few plants near the base ; but the quantity growing in the interstices of the brickwork near the top was so great as to give the tower a mossy appearance when looked at from the ground. The plants were quite inaccessible, and I could identify the species only by means of a good glass. Clacton is in Gibson's Eighth District, from which he had no records for the plant.

Again, within the last few weeks, Mr. H. Mothersole and myself found the plant growing in great profusion on the brick viaduct which carries the main line of the Great Eastern Railway over the valley of a little brook in the parish of Boreham. The plants grew in large tufts on the sides of the viaduct and to a lesser extent under the arches. Many of the fronds were of exceptional size—perhaps on account of the wetness of the past summer. — MILLER CHRISTY, F.L.S., Broomfield, Chelmsford.

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I am very desirous of obtaining this spring good specimens of our Essex Fresh-Water Fishes for preservation in the wet and dry way, both for the Essex Museum and for the Forest Museum.

Perhaps some of our Angler Members will kindly help me in this way. For the wet preparations well-marked fish of moderate size would be best (not in any case exceeding 11 or 12 inches). For dry preparations' restriction of size is not so rigid, but we have not room for large specimens.

Species specially needed, are: Miller's Thumb, Grayling, Gudgeon, Chubb, Dace, Tench, Loach, Bleak, Rudd, and Lamprey.

Fish should be sent carefully packed in damp weed. All expenses of carriage, etc., will be refunded.

Please send post card or letter advising, with details of locality, etc., and address all to me at

The Essex Museum of Natural History,
Romford Road,

Stratford, Essex.

I have made several appeals on this page with no great results, but I do hope that now some aid will be given. It is impossible for one collector to work so large a district as ours, and besides the work of curatorship becomes more onerous every year, and leaves but scanty time for collecting.

WILLIAM COLB, *Curator.*

February, 1904.



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BEING THE
JOURNAL
OF THE
ESSEX FIELD CLUB,

EDITED BY
WILLIAM COLE, F.L.S., F.E.S.,
Honorary Secretary and Curator.

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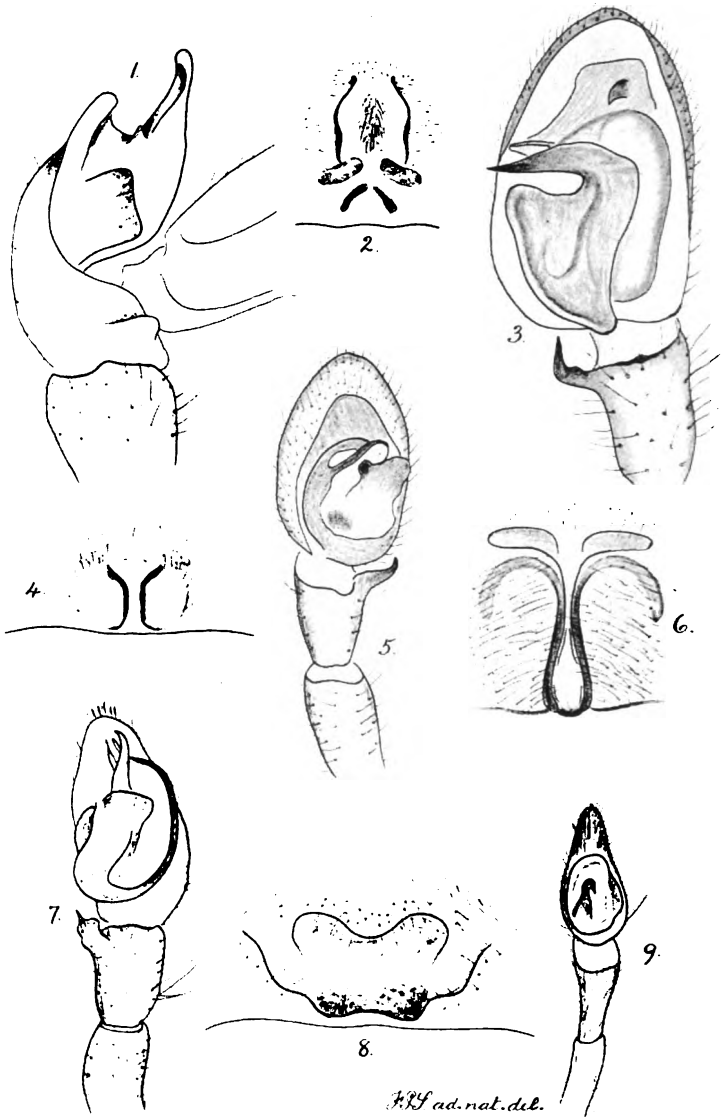
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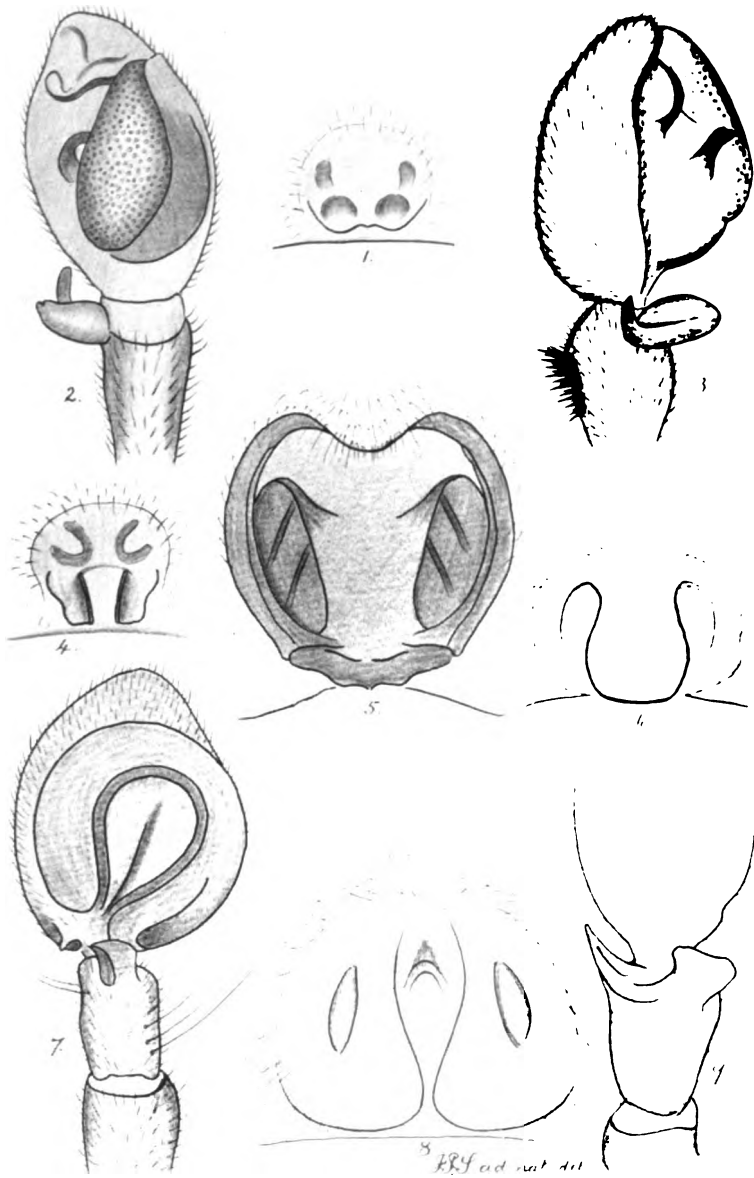
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PALEP AND OTHER ORGANS OF SPIDERS.

For a complete list of the plates.



PALPI AND OTHER ORGANS OF SPIDERS.
Fig. 1-8. See text.

THE SPIDERS OF EPPING FOREST.

By FRANK P. SMITH.

(Continued from page 60).

(With Plates IX. and X.)

Family ANYPHAENIDAE.

[Drassidae, Cambr. List, *ad partem*.]

This family is very closely allied to the Clubionidae, but the single genus represented in Britain may be easily distinguished from that family by the tubetracheal opening being placed not immediately in front of the spinnerets, but in a conspicuous transverse depression about half-way between the genital aperture and the posterior extremity of the abdomen.

Genus ANYPHAENA, Sund.

Spiders of moderate size, usually with distinct blackish markings upon the pale abdomen. The males are often much more darkly coloured than the females. A single species occurs in Britain.

Anyphaena accentuata, Walck. Commonly beaten from trees in many parts of the forest.

Family SPARASSIDAE.

Cephalo-thorax longer than broad, strongly constricted at the caput. *Eyes* 8, almost homogeneous (of the diurnal type), rather small, not greatly unequal in size, anterior row recurved, posterior row unusually procurved. *Clypeus* narrow. *Labium* short, almost semicircular. *Maxillae* rather straight, never much inclined towards the labium. *Legs*, second pair shorter than fourth pair. Spines present and fairly strong. Claw tuft and scopula present. Tarsal claws, 2.

The Sparassidae are spiders intermediate in characteristics between the Clubionidae and the Philodromidae. They spin no snare. One genus is found, but rarely, in Britain.

Genus SPARASSUS, Walck.

[Micrommata, Cambr. List.]

Spiders of rather large size and brilliant colours which have many structural affinities with the Clubionidae, but in their habits remind one more strongly of the Philodromidae. One rare and beautiful species, *S. virescens*, Clk, has occurred in Britain, but not in Epping Forest.

Family PHILODROMIDAE.

[Thomisidae, Cambr. List, *ad partem* Philodrominae.]

Cephalo-thorax short and broad, strongly constricted in the region of the caput, and obtuse and rounded in front. *Eyes* eight, of the diurnal type, not greatly unequal in size, arranged in two recurved rows, the whole group describing a figure of a more or less crescent-like form. *Legs*; relative length varies in different species. Those of the first and second pairs are always somewhat

longer than those of the third and fourth pairs, but seldom greatly so. Claw tufts are usually well-developed. *Abdomen* usually somewhat short, often broader behind than in front. *Spinners* very short and compact.

The spiders of this family are usually found upon shrubs and trees. They spin no snare but capture their prey by stealth. In their movements they are very similar to the Thomisidae, but their rate of progression is much greater, and they are consequently somewhat difficult to capture. If a specimen be held by a single leg, it will at once escape by parting company with the imprisoned member.

TABLE OF PHILODROMIDAE.

- | | | | | |
|----|---|--|---------|--------------------|
| 1. | Cephalo-thorax wider than long. | Legs IV. longest | .. | <i>Thanatus</i> |
| | Cephalo-thorax as long as, or longer than wide. | Legs II. longest | .. .. . | 2 |
| 2. | Cephalo-thorax about as wide as long. | Eyes of posterior row nearly equidistant | .. .. . | <i>Philodromus</i> |
| | Cephalo-thorax considerably longer than wide. | Posterior lateral eyes widely separated from the central | .. | <i>Tibellus</i> |

Genus TIBELLUS, *Simon*.

The long and narrow cephalo-thorax and abdomen and the arrangement of the eyes will be quite sufficient to identify this genus. It contains one species which is not common, but widely distributed in Epping Forest.

***Tibellus oblongus*, Walck.** Occurs in several localities, amongst coarse grass and rushes. It often rests with its four anterior legs stretched forward, and the posterior backwards upon a dry grass blade or sedge, and in that position is only detected with great difficulty.

Genus THANATUS, *C. L. Koch*.

Thanatus striatus, C. L. Koch, is not uncommon in Britain, and *T. formicinus*, Clk., has also been taken, but neither has, up to the present, occurred in the Forest.

Genus PHILODROMUS, *Walck*.

This genus includes a considerable number of British spiders which are found, as a rule, upon trees and shrubs, and usually obtained by beating. They run with great rapidity, and in a peculiarly erratic manner. Epping Forest seems to be unexpectedly poor in these spiders, only three species having been recorded.

***Philodromus aureolus*, Clk.** This species occurs in profusion in many parts of the Epping Forest. There is a very

distinct variety, *cespitolis*, Walck, regarded by some authors as a separate species, which is found commonly in Britain, but I have never seen it in the Forest.

Philodromus dispar, Walck. A few specimens from near Theydon Bois.

Philodromus margaritatus, Clk. A single specimen from Chingford.

The following British species of *Philodromus* have not, up to the present, been taken in Epping Forest:—*P. fallax*, Sund.; *P. elegans*, Bl.; *P. emarginatus*, Schr.; *P. constellatus*, Sim; *P. clarkii*, Bl.; *P. variatus*, Bl.; *P. mistus*, Bl.; *P. prædatus*, Cb; *P. lineatipes*, Cb.

Family THOMISIDAE.

[Thomisidae, Cambr. List *ad partem* Thomisinae.]

Cephalo-thorax short and very broad, strongly constricted at the caput, which is truncated in front. *Eyes* homogeneous, of the diurnal type, arranged usually in two rows which after enclose a crescent-shaped figure. *Clypeus* high, more or less vertical. *Falces* small, often very weak. *Legs* very unequal in length, those of the first and second pairs being much the largest and strongest. *Tarsal claws* two, but almost always without either claw-tuft or scopula. *Abdomen* short, broadest towards its hinder part, marked upon its upper surface with five impressed spots which form a triangle with its apex in front. Spinners short and compact.

This family includes all the typical crab-spiders. It is by no means extensively represented in Epping Forest as far as our present knowledge goes.

TABLE OF THOMISIDAE.

- | | |
|--|-----------------|
| 1. Curve of posterior row of eyes less strong than that of the anterior row. Lateral eyes upon a common protuberance | 2 |
| Curve of posterior row of eyes equal to, or stronger than that of the anterior row. Lateral eyes upon separate protuberances | 4 |
| 2. Quadrangle formed by the central eyes longer than wide | <i>Pistius</i> |
| Quadrangle formed by the central eyes not longer than wide, usually wider than long | 3 |
| 3. Clypeus inclined, as high as ocular area, vertical. Front of caput angularly produced | <i>Thomisus</i> |
| Clypeus lower than ocular area, vertical. Front of caput obtuse, not produced | <i>Misumena</i> |
| 4. Quadrangle formed by the central eyes longer than wide | 5 |
| Quadrangle formed by the central eyes not longer than wide, often wider than long | <i>Xysticus</i> |
| 5. Posterior row of eyes very strongly curved, the centrals | |

being very close together. Integument more or less coriaceous, usually furnished with obtuse or clavate bristles *Oxyptila*
 Posterior row of eyes moderately curved, equidistant.
 Integument not at all coriaceous, furnished with simple hairs *Diaea*

Genus XYSTICUS, C. L. Koch.

Crab-spiders of moderate size, with distinct patterns upon both cephalo-thorax and abdomen, usually of various shades of brown, reddish brown, and buff. The males are far smaller than the females, with proportionally longer legs, and are usually of a much darker hue. The palpi of the males are very short, and the tarsal joints rather large. The specific characters in this sex are very distinct, but the females are not by any means easily identified. The genus is a large one, but is very badly represented in Epping Forest.

Xysticus cristatus, Clerck. Common in all parts of the Forest, amongst grass, heather, and other low herbage.

Xysticus pini, Hahn. A female which appeared to belong to this species was taken at Theydon Bois.

Xysticus erraticus, Bl. A female from Loughton is the only record.

The species of *Xysticus* found in Britain but not as yet recorded from the Forest are as follows:—*X. lanio*, C. L. Koch; *X. robustus*, Hahn; *X. brevipes*, Bl.; *X. sabulosus*, Hahn; *X. ulmi*, Hahn; *X. luctuosus*, Bl.; *X. luctator*, L. Koch; *X. kochii*, Thor.; *X. bifasciatus*, C. L. Koch; and *X. lynceus*, Latr. (a somewhat doubtful species).

Genus OXYPTILA, Simon.

Curious little crab-spiders, usually of dark colours, reddish-brown, chocolate and yellowish-brown being the prevailing tints. The integument is often somewhat coriaceous and is usually furnished with peculiar obtuse or even clavate bristles. Most of the species are found upon the ground amongst herbage, especially in moist localities, well-watered meadows being favourite habitats. A few species may be occasionally beaten from trees.

Oxyptila praticola, C. L. Koch. Beaten from trees in various parts of the Forest. Not at all uncommon.

Oxyptila simplex, Cambr. A couple of females, apparently

of this species, were found amongst heather near the "Robin Hood."

Oxyptila atomaria, Panz. A single female, taken somewhere in the Forest a few years ago, is my only record, but unfortunately the locality was not noted at the time of capture.

The British species not yet found in the Forest are *O. trux*, Bl.; *O. flexa*, Cambr.; *O. sanctuaria*, Cambr.; and *O. blackwallii*, Simon.

Genus DIAEA, Thorell,

Crab-spiders of moderate size and of brilliant colours, green being a prevailing tint. The sexes are exceedingly dissimilar.

Diaea dorsata, Fabr. The female of this beautiful green spider has been taken on several occasions at Loughton and Theydon Bois.

Two other species are recorded as British, *D. formosa*, Bl.; and *D. devoniensis*, Cambr.

Genus MISUMENA, Simon.

Large spiders of uniform pale tints. One species occurs in Britain, and is not uncommon in the Forest.

Misumena vatia, Clerck. Found hiding amongst the blooms of various plants, where it lies in wait for unsuspecting insects who visit the flowers in search of honey.

Genus PISTIUS, Simon.

A single species of this genus, *P. truncatus*, Pallas, is found in Britain, but it has not occurred in the Forest.

Genus THOMISUS, Walck.

In this genus the caput is peculiarly angular, and the abdomen abruptly truncated at its posterior extremity. A single species occurs in Britain.

Thomisus onustus, Walck. An immature male amongst heather near the "Robin Hood" is, at present, the only record for the Forest.

Family SALTICIDAE.

Cephalo-thorax large compared with the abdomen, very wide in front, its sides being often nearly parallel. *Eyes*, eight, of the diurnal type. Four large eyes form a transverse row upon the front of the caput, the remainder being small, and arranged in a quadrate figure upon the upper surface of the cephalo-thorax. *Falces* usually normal, but in some cases peculiarly exaggerated in the male sex. *Sternum* narrow. *Palpi* normal, that of the male being furnished with an apophysis upon the tibia, and occasionally upon the femur

also. *Legs* short, strong, adapted for leaping, not greatly spinose, those of the first and second pairs being often abnormally developed. *Tarsal Claws*, two, a claw-tuft being present.

This is perhaps the most sharply-defined of the spider-families, its representatives being easily recognised by the arrangement of their eyes and by their saltatorial habits. Many of the species are brilliantly coloured, and are in some cases ornamented with beautiful iridescent scales. The Salticidae are for the greater part inhabitants of the warmer regions of the globe. Thirty-four species are recorded as British, but Epping Forest has, up to the present, furnished us with only ten, representing eight genera.

TABLE OF SALTICIDAE.

1.	Spiders of ant-like form, with the pedicle between cephalo-thorax and abdomen very long and visible from above	2
	Pedicle normal	3
2.	Falces of ♂ normal. Caput level with thorax ..	<i>Synageles</i>
	Falces of ♂ enormously developed, horizontally extended. Caput somewhat raised	<i>Toxens</i>
3.	Posterior row of eyes set far back upon the cephalo-thorax, and at its widest part	4
	Posterior row of eyes in front of widest part of cephalo-thorax	5
4.	Posterior row of eyes longer than the anterior ..	<i>Ballus</i>
	Posterior row of eyes equal in length to the anterior ..	<i>Neon</i>
5.	Coxæ I. very close together	6
	Coxæ I. well separated	7
6.	Patella I. almost as long as tibia I. Tarsus of male palpus very wide	<i>Marpessa</i>
	Patella I. considerably shorter than tibia I. Tarsus of male palpus narrow	<i>Hytia</i>
7.	Tibia + patella III. at least as long as tibia + patella IV.	8
	Tibia + patella III. shorter than tibia + patella IV. ..	10
8.	Anterior row of eyes moderately curved	<i>Aelurops</i>
	Anterior row of eyes very slightly curved	9
9.	Tibia + patella IV. longer than tarsus + metatarsus IV. ..	<i>Pellenes</i>
	Tibia + patella IV. not longer than tarsus + metatarsus IV.	<i>Hasarius</i>
10.	Metatarsus IV. without spines except at its extremity ..	11
	Metatarsus IV. with numerous spines	12
11.	Femora and tibiae with spines. Falces of male normal ..	<i>Dendryphantus</i>
	Femora and tibiae without spines. Falces of male excessively developed and horizontal	<i>Salicus</i>
12.	Anterior row of eyes strongly curved	<i>Philaenus</i>
	Anterior row of eyes straight or nearly so	13

- | | | |
|---|----|--------------------|
| 13. Patella III. at least as long as patella IV. .. | .. | <i>Euophrys</i> |
| Patella III. shorter than patella IV. .. | .. | 14 |
| 14. Palpus of male with femoral apophysis .. | .. | <i>Heliophanus</i> |
| Palpus of male without femoral apophysis .. | .. | 15 |
| 15. Caput about half the length of thorax .. | .. | <i>Phlegra</i> |
| Caput much more than half the length of thorax .. | .. | <i>Attus</i> |

Genus SALTICUS, Latr.

[*Epiblemum*, Hentz, Cambr. List.]

This genus includes several small spiders with the abdomen of a blackish tint ornamented with diagonal bands of white scales.

Salticus scenicus, Clerck. The well-known "Zebra-spider" of our gardens. Common in many parts of the Forest upon palings.

Salticus cingulatus, Panz. A few specimens found upon willow trunks on Edmonton Marshes.

A third species is found in Britain, *S. affinitatus*, Cambr.

Genus MARPESSA, C. L. Koch.

Large Salticids, usually of plain tints, but nevertheless very beautifully marked. They are not easily seen when motionless upon palings on account of their striking resemblance to splashes of mud.

Marpessa muscosa, Clerck. Upon palings in Wanstead Park, and several other parts of the Forest.

Two British species, *M. pomatia*, Walck, and *M. melanognatha*, Luc. have not yet occurred in the Forest area.

Genus HELIOPHANUS, C. L. Koch.

Many of the species of this genus are of various tints of dark metallic green. They are very active spiders, and may usually be found upon sunny days running amongst low plants and adroitly jumping from leaf to leaf.

Heliophanus cupreus, Walck. This species has occurred at Loughton, Theydon Bois, and Epping.

Two other British representatives of this genus, *H. expers* Cambr., and *H. flavipes*, C. L. Koch, have not been definitely recorded from the Forest, but several immature specimens taken near Loughton certainly had the appearance of belonging to the last-mentioned species.

Genus BALLUS, C. L. Koch.

Small, dull-coloured Salticids, of a very flattened form, found

upon bushes and low herbage. I have taken the only British species on several occasions in the Forest.

Ballus depressus, Walck.—Found at Loughton, amongst heather and low herbage, and also by beating furze bushes in bloom.

Genus NEON, Simon.

Small, active spiders, usually found amongst low herbage.

Neon reticulatus, Bl.—Found by Rev. O. P. Cambridge, near Loughton. I have never myself taken it in the Forest area.

N. levis, Sim., also occurs in Britain, but has not yet been found in the Forest.

Genus DENDRYPHANTES, C. L. Koch.

The single British species, *D. hastatus*, C. L. Koch, has not occurred in the Forest.

Genus HYCTIA, Simon.

One rare species, *H. nivoyi*, Luc., occurs in Britain, but has not been found in Epping Forest.

Genus EUOPHRYS, C. L. Koch.

Small active spiders, of plain colours, but usually prettily marked. They are found commonly on the outskirts of woods and upon sunny banks, especially in sandy districts.

Euophrys frontalis, Walck. Not uncommon in many parts of the Forest district. The male is much more darkly coloured than the female, especially in the region of the caput.

Three other species are found in Britain, *E. erraticus*, Walck.; *E. aequipes*, Cambr.; and *E. petrensis*, C. L. Koch.

Genus HASARIUS, Simon.

Handsome spiders, of moderate size, usually found upon bushes and shrubs. Their legs are powerful and they jump with great rapidity.

Hasarius falcatus, Bl. This species is fairly common upon herbage in various parts of the Forest, notably the district between Theydon Bois and Epping.

Hasarius arcuatus, Clk. Several specimens of this rarity have occurred in the forest, one being from Loughton.

Three other species have been recorded as British, *H. latabundus*, C. L. Koch; *H. adansonii*, Sav.; and *H. nicholsonii*, Cambr. The last two species are in all probability importations,

and might very possibly be found in the green-houses of some of the Forest nurseries.

Genus ATTUS, Walck.

Small spiders, usually of sombre tints, found upon walls and amongst herbage.

Attus pubescens, Fabr. This small, dark-coloured spider has occurred upon garden walls at Chingford. It is not rare in London gardens, and is a most interesting creature, stalking its prey with great skill and taking advantage of small holes in the bricks for purposes of concealment.

Four other species are recorded as British, viz., *A. manicis*, Thor.; *A. saltator*, Sim.; *A. floricola*, Walck.; and *A. caricis*, Westr.

Genus PHLEGRA, Simon.

One rare species of this genus, *P. fasciata*, Hahn., has occurred in Britain, but not in the Forest.

Genus PHILAEUS, Thorell.

P. chrysops, a beautiful and rare species is recorded as British but has not yet turned up in the Forest area.

Genus AELUROPS, Thorell.

A. v-insignatus, Clk. This species occurs pretty plentifully in some of the Eastern counties, but is very local. It has not been taken within the Forest area.

Genus PELLENESE, Simon.

One rare species is recorded as British, *P. tripunctatus*, Walck., but it has not been found in Essex.

Genus TOXEUS.

[*Salticus*, Latr. Cambr. List.]

An extremely rare and most interesting species, *T. formicarius*, Walck., which is one of the most perfect of the ant-mimicking spiders, has been taken in Britain, but we have no Epping Forest record.

Genus SYNAGELES, Simon.

These spiders also possess a very marked resemblance to ants. We have one species in Britain, *S. venator*, Luc., but apparently it has not occurred in Essex. Quite recently it was taken in some numbers at Wicken Fen, but it must be regarded as one of our rarest spiders.

EXPLANATION OF PLATES.

PLATE IX.

1. *Clubiona coerulescens*, Tibia of ♂ palpus.
2. *Agroeca proxima*, ♀ genital area.
3. *Agroeca brunnea*, part of palpus of ♂
4. *Zora maculata*, ♀ genital area.
5. *Agroeca proxima*, part of palpus of ♂
6. *Agroeca brunnea*, ♀ genital area.
7. *Zora maculata*, part of palpus of ♂
8. *Micaria pulicaria*, ♀ genital area.
9. *Micaria pulicaria*, part of palpus of ♂

PLATE X.

1. *Tibellus oblongus*, ♀ genital area.
2. *Anyphaena accentuata*, part of palpus of ♂
3. " " " another view.
4. *Philodromus dispar*, ♀ genital area.
5. *Sparassus virescens*, ♀ genital area.
6. *Philodromus aureolus*, ♀ genital area.
7. *Philodromus dispar*, part of palpus of ♂
8. *Anyphaena accentuata*, ♀ genital area.
9. *Philodromus aureolus*, part of palpus of ♂

[N.B. Figures relating to some of the species in the above instalment of the paper will be given on future plates.—Ed.]

(To be continued.)

HISTORY OF ESSEX BOTANY.

By Prof. G. S. BOULGER, F.L.S., F.G.S., *Vice-President*.

PART I. (*continued from Vol. XI., p. 236*).

THE BOTANISTS OF THE SIXTEENTH AND SEVENTEENTH CENTURIES.

Since the publication of the previous instalment of this paper I have discovered four oversights. On p. 172, of vol. xi., after Gerard's record of *Potentilla palustris*, the following should have appeared :—

p. 847. *Angelica silvestris*. "I have seene the same in lowe fennie and marshie places of Essex, about Harwich : this plant hath leaves like unto the garden Angelica, but smaller, and fewer in number, set upon one ribbe, a great stalke, grosse and thicke, whose ioints, and that small rib whereon the leafe groweth, is of a reddish colour, having many long branches comming forth of a huske or case, such as is in the common garden parsnep : the flowers grow at the top of the branches, of a white colour and tuft fashion, which being past there succede broad, long and thicke seeds, longer and thicker than garden Angelica : the

roote is great, thicke, and white, of little savour, with some strings appendant thereto." [*Angelica sylvestris* L.]

Between the publication of Gerard's *Herball* and the 'emaculate' edition of Thomas Johnson (1633), the second edition of Pena and Lobel's *Adversaria* was published by Lobel in 1605. It contains the first British record for *Polypogon monspeliensis* Desf. (p. 469), as follows:—

"*Alopecurus altera maxima Anglica paludosa*. . . . Vdis fossis lacustribusq. Essexiensis comitatûs legi, juxta Thamesis amœnissima fluenta, . . . cum tenderemus ad œdes Clarissimi & pijssissimi generosi viri D. J. Coys hujus amœnissimi studii amantissimi & ut si quis alius Anglo-britanorum peritissimi, herbidos campos perlustratur."

On p. 175 of vol. xi., after Johnson's record of *Anagallis cœrulea*, should have appeared the following:—

p. 630. "*Nummularia flore purpurascente*. Purple floured Money-woort . . . "on the bogges upon the heath," neare Burnt wood in Essex." [*Anagallis tenella* L.]

After his record of *Trifolium fragiferum* on the same page, the two following records should appear:—

p. 1482. "*Ulmus folio glabro*. Witch Elme, or smooth leauen Elme. . . . My worthy friend and excellent Herbarist of happy memorie, Mr. William Coys, of Stubbers, in the parish of Northokington, in Essex, told me that the wood of this kinde was more desired for naves of Carts than the wood of the first. I observed it growing very plentifully as I rode between Rumford and the said Stubbers, in the yeere 1620, intermixed with the first kinde, but easily to be discerned apart, and is in those parts usually called Witch-Elme." [*Ulmus surculosa* var. *glabra* Mill.]

p. 1490. *Lantana, sive Viburnum*. The Wayfaring tree. . . . "I enquired of a countreyman in Essex, if he knew any name of this: he answered, it was called the Cotton tree, by reason of the softnesse of the leaves." [*Viburnum lantana* L.]

There is a great contrast between Merrett's work and that of the greatest of Essex naturalists which follows it. The Club has in the fourth volume of its *Transactions* and *Proceedings* a fuller account of the life of Ray than is accessible elsewhere,¹ so that the barest summary will suffice here. Ray was born at Black Notley, probably on 29th November, 1627. From Braintree Grammar School he entered Catherine Hall, Cambridge, in 1644; migrated to Trinity College in 1646; graduated and held

¹ "The Life and Work of John Ray, and their relation to the Progress of Science." By G. S. Boulger. *Trans. Essex Field Club*, vol. iv., pp. 171-188. "The Domestic Life of John Ray at Black Notley." By G. S. Boulger. *Journ. of Proc. Essex Field Club*, vol. iv., pp. clix.-clxiv.

various college offices before his ordination in 1660. In that year he issued anonymously his *Catalogue of Cambridge Plants*, two appendices to which were published in 1663 and 1685 respectively. In the former of these appendices occurs the first British record of *Bupleurum tenuissimum* L. Then, having lost his fellowship, and retired into lay communion, in consequence of the Bartholomew Act, after several tours through England, Wales, and the Lowlands of Scotland, and his continental journey with Willughby in 1663, Ray became domesticated with his most celebrated pupil at Middleton. In 1667 he became a Fellow of the Royal Society, and in 1670 he published his *Catalogus Plantarum Angliæ*, for twenty years the handbook of British botanists. This little work enumerates 27 Essex species, of which 17 were new to Essex.

They are the following :—

- Polypogon monspeliensis* Desf. (from Lobel), p. 15.
- Asparagus officinalis* L. (from Gerard), p. 31.
- Bupleurum tenuissimum* L., p. 37.
- **Lathyrus nissolia* L., p. 61.
- “*Conserva palustris*,” p. 78.
- Crocus sativus* L. (from Gerard), p. 87.
- Cynoglossum germanicum* Jacq. (from Gerard), p. 90.
- **Frankenia laevis* L., p. 101.
- **Fagopyrum esculentum* Moench, p. 111.
- **Carex pendula* Huds., p. 147.
- **Lepturus filiformis*, Trin. var. *incurvatus*., p. 152.
- **Calamagrostis epigeios* Roth., p. 152.
- **Juncus maritimus* Sm., p. 179.
- Lathyrus hirsutus* L. (from Merrett), p. 190.
- Lepidium latifolium* L., p. 191.
- Statice limonium* L., p. 194.
- **Cardamine amara* L., p. 220.
- **Berberis vulgaris* L., p. 229.
- †*Potamogeton interruptus* Kit., var. *scoparius*, p. 251.
- Thlaspi arvense* L., p. 295.
- **Lepidium rudemale* L., p. 296.
- Tilia vulgaris* Hayne (from Turner), p. 297.
- Tilia platyphyllos* Scop., p. 297.
- **Trifolium squamosum* L., p. 306.
- **T. subterraneum* L., p. 306.

**Typha latifolia* L., p. 308.

**T. angustifolia* L., p. 308.

Those new to Essex are marked with an *, those new to Britain with †. As I have quoted the pages, and there are seldom two Essex species on one page, no one need have any difficulty in testing my identifications. Some of these records demand fuller notice.

"*Auricula leporis minima* J.B. An *Bupleurum minimum* Park? An *Bupl. angustissimo folio* C.B. The least Hares-ear. Deceptum puto Gerardum, cum *Bupleurum angustifolium* Dod. apud nos sponte provenire asserat. Illud sc. mihi nunquam occurrit, at hæc a J. Banhino tom. 3. part. 2. pag. 201. descripta sæpius. As near Ellesley in the road from Cambridge to St. Neotes, on a bank by the Northern roadside a little beyond Huntingdon. At Maldon in Essex, in a yard where they build vesels at Fullbridge: at Hastings in Sussex, near the little brook that runs beside the castle, below the bridge, and elsewhere. . . . Accuratam ejus tum figuram tum descriptionem vide apud J.B. loco citato."

When, in 1831, Thomas Corder recognised *Bupleurum falcatum* and described it in the supplement to *English Botany*, he stated, on the authority of Edward Forster, that Gerard and others had previously noticed it in England, quoting the figure in Johnson's *Gerard*, p. 608. Though neither Gerard's nor Johnson's figures are satisfactory means of identifying the plants described by them, and, as Mr. Gibson says (*Flora of Essex*, p. 135), this figure "seems more like some other species," the description is even less satisfactory. According to the synonymy quoted, this species and *B. rigidum* (unknown in Britain) occurred together at Beeston Castle, Cheshire, a possible locality for *B. tenuissimum* (though not mentioned in the late Lord De Tabley's *Flora*), but most improbable for the others. *B. tenuissimum* is mainly a salt-marsh species, though not exclusively so, and is still not uncommon on the east coast of our county. It may at any time have been introduced, as Watson suggests,² with sea-side gravel brought inland for footpaths, though several of the recorded inland localities are naturally gravelly spots, as, for instance, Ealing Common (*Flora of Middlesex*, p. 126). In Dale's herbarium is a specimen labelled by him "*Bupleurum angustissimo folio* C.B. 278. *Tourn. Inst.* 310. *Bupleurum minimum* Col. *Ecp.* 1. 247. *Park. Auricula leporis minima* J.B. 3. 201. *Raii Hist.* 1. 474. *Synop.* 115. *Cat. Angl.* Apud Maldon collegi." There are also in the British Museum Herbarium (1)

² *Topographical Botany*, ed. 1., p. 630.

Sir John Hill's specimen, labelled "The least Hares-eare. *Bupleurum minimum* R.S. pag. 221. This grows in dry, sandy places—as by the road-side going from Laingdon Hills to the Saltmarshes, a mile from the Hills. It flowers in July : " (2) one from the Banksian herbarium, labelled "Maldon, Essex, Mr. Lightfoot, 1775" : (3) three from Edward Forster's, labelled respectively "*Bupleurum tenuissimum*. On a common between Warley Street and Hare Hall, 1793" ; "near South End ;" and "on the wall of the Blackwater between Heybridge and Goldhanger, near Maldon, 1793" ; (4) one from Dr. Varenne labelled "Walton-on-the-Naze, 1867" ; and (5) one from Mr. Arthur Bennett from "Near Southend, Sept. 1882." Parkinson, in the *Theatrum* (p. 578), mentions a *B. minimum* as well as *B. angustifolium* and *B. latifolium*, but only speaks of the two last-mentioned as British. How, in his *Phytologia* (p. 18), records "*Bupleurum minimum* nondum descriptum floribus luteis. The smallest Hares-eare with yellow flowers : found in Surrey," a record which Mr. Clarke quotes,³ with a query, under *B. tenuissimum* ; and Merrett (*Pinar.* p. 17) lumps *Bupleurum angustifolium monspeliense*, G. 608, with *B. minimum*, p. 578, and records it from "betwixt Bromeley and Eltham in Kent, and at Paddington beyond the Bridge in the way to Harrow." This reference is quoted by Edward Forster (E.B.S. 2763) for *B. falcatum*, a determination in which Messrs. Trimen and Dyer do not concur (*Flora of Middlesex*, loc. cit.). Blackstone's record (*Specimen Botanicum* (1746), p. 8) "*Bupleurum minimum* Park. 578, angustissimo folio, C. B. Pin. 278. . . . By the roadside, near Thorndon, Essex, Mr. Hill," probably refers to Hill's specimen now in the British Museum Herbarium and is, therefore, *B. tenuissimum*, as inferred by Gibson (*Flora of Essex*, p. 134). Thus there is no satisfactory record of *B. falcatum* before Thomas Corder's in 1831, whilst Brewer's record of this species from Reigate Heath (*Flora of Surrey*, p. 101) is not above suspicion.

"*Catanance leguminosa* quorundam J. B. . . . Crimson-grass-Vetch. I have found it in many places, as in the bushes about Paneras-church near London, at Black-Notley in Essex."

This is a record mainly interesting as being one from Ray's

³ *First Records of British Fencing Plants*, ed. ii., p. 60.

native parish. The plant, *Lathyrus nissolia*, is not infrequent throughout the county.

"*Erica supina maritima Anglica* Park. Lob. English low Sea-Heath. I have found this in several places, as in Loving-land, just over the water at Yarmouth and in the marshes about Thurrington in Essex." [*Frankenia laevis* L.]

"*Fegopyrum* Dod . . . Buckwheat, in some places called Brank, in others Crop. . . circa Colcestrum." [*Fagopyrum esculentum* Mœnch.]

"*Gramen cyperoides spicâ pendulâ longiore* Park . . . Bastard Cyperus-grass, with long pendulous heads . . . In fossis Notleiae . . . copiose." [*Carex pendula* Huds.]

"*Gramen parvum marinum spicâ loliaceâ* Ger. emac lib. I. cap: 22. n. 8 . . . Dwarf-Darnel-grass. . . . juxta Camalodunum. *Hull-bridge*, & alibi in Essexia." [*Lepturus filiformis*, var. *incurvatus* (Trin.)]

"*Lepidium latifolium* C.B. . . . Dittander or Pepperwort. Near Fullbridge at Maldon, the hith at Colchester, and elsewhere in Essex." [*Lepidium latifolium* L.]

"*Limonium Ger.*" To which is added the note to which reference has already been made, "*Alteram speciem à Lobelio inventam in agris Colcestrensibus propè mare memorat Parkinsonus . . . Ego unicum dumtaxat speciem in Anglia spontaneam agnosco.*"

Potamogeton pusillum gramineo folio maritimum, Sea-Pondweed, with grassie leaves. This grows in the ditches of water in the salt-marshes, into which the water flows every Tide. About Maldon . . . "

In the *Historia* vol. i., p. 190, n^o. 9, this is recorded from "Tidal ditches in salt marshes," and from the specimen in the Sloane Herbarium there referred to, this plant appears to be *Potamogeton interruptus* Kit. var. *scoparius*, i.e. *P. marinus* of Hudson, but not of Linnæus.

"*Thlaspi* Dioscoridis. . . . *Treacle Mustard*. Cornfields about Wormingford" [*Thlaspi arvense* L.]

"*Thlaspi minus Ger.* angustifolium Fuchsii, *Nasturtium sylvestre* J. Bauhini J. B. *Nasturtium sylvestre* L., seu *Osyridis folio* Park. C. B. *Bowyer's Mustard*. . . . Near the Sea in many places, v.g., Maldon in Essex." [*Lepidium rudemale* L.]

"*Tilia* fœmina *Ger.* fœmina major Park. fœmina folio majore C.B. vulgaris platyphyllos J.B. *The female Lime, Liné or Linden-tree*. . . . In Essexia in nemore duobus à Colcestrum mill. *Tur.*" [*Tilia vulgaris* Hayne.]

This is the form which, as already pointed out [*Essex Naturalist* xi., pp. 59-60], Ray in his *Historia* doubts as indigenous.

"*Tilia folio minore* J.B. fœmina minor Park. fœmina folio minore C.B. Small leaved Lime, or Linden-tree; in some Countreys called Bast. . . . In

Essexia plurimam observavi circa Boreham, Terling, Heveningham, & alibi. [*Tilia platyphyllos* Scop.]

"*Trifolium stellatum* glabrum Ger. emac. . . . I found near the water-side at Lighe in Essex. [*Trifolium squamosum* L., i.e. *T. maritimum* Huds.]

"*Trifolium pumilum* supinum flosculis longis albis P.B. . . . in the road between Burntwood and Brook-street in Essex, &c., abundantly." [*Trifolium subterraneum* Linn.]

"*Typha palustris* major J.B." and "*Typha palustris* media J.B."
 "Utramque speciem simul vidi in rivulo quodam juxta sedes Nobiliss. Comitum Warwicensis *Lees-house* dictas in Essexia." [*Typha latifolia* Linn. and *T. angustifolia* Linn.]

The second edition of the *Catalogus*, which appeared in 1677, contains no additional Essex matter; but in 1686 and 1688 appeared the first and second volumes of the *Historia Plantarum*. From 1666 to 1676 Ray's home had been at Middleton in Warwickshire; from Michaelmas 1677 till June, 1679, he was living with Edward Bullock at Faulkbourne Hall; and for the remaining twenty-five years of his life his home was the Dewlands, Black Notley (the house unfortunately burnt down recently), where he died on January 17th, 1705. It was, no doubt, on his settling at Black Notley that Ray first became intimate with Samuel Dale, physician and apothecary of Braintree. Born in 1658 or 1659, Dale was some thirty years Ray's junior, and we have no knowledge as to when the younger man settled at Braintree. In the Preface to his *Pharmacologia* (1693), Dale speaks of himself as "*Primo initiatus sub Auspiciis Excellentissimi Viri et Reipublicæ Philosophicæ Principis Dignissimi, Joannis Raii.*" While Ray's delicate health and enormous literary toil confined him very much to his own home, his young disciple, in pursuit at once of his profession and of his hobby, visited many parts of Essex and Suffolk, besides making occasional journeys to greater distances. Gifted undoubtedly with great critical acumen, and confining his attention mainly to British plants, Dale seems in accuracy of detail even to have surpassed his master; and the value of his services to Ray is evinced by the way in which he is spoken of, when only six or seven and twenty, in the Preface to the first volume of the *Historia* (1686). Ray's words are "*D. Samuel Dale, Medicus et Pharmacopæus vicinus et familiaris noster, Brantrix in Essexia degen., qui libris diligenter collatis Synonyma examinavit, errata correxit, et omissa supplevit, præterea si quas species per incuriam aut festinationem omissas observavit, ne commonefecit,*

ut ejus ope Historia nostra aliquot mendis repurgata, et speciebus aucta sit." In the first two volumes of the *Historia*, which comprise nearly 2,500 pp. folio, some 6,900 plants are described. Of these only a comparatively small proportion are British and of these last only the less common are localised, so that the number of species recorded from Essex is not very great. Though many of these were the result of Dale's collecting, there are others, chiefly from Faulkbourne or Black Notley, sufficient to disprove the notion that Ray was entirely a closet naturalist.

A third edition of the *Catalogus* being required, Ray, as he had been advised by his friend, Dr. Ralph Johnson, determined to replace its merely alphabetical arrangement by one in accordance with his views on taxonomy; but, as a preliminary, issued in the same year as the second volume of the *Historia*, a 27 pp. supplement to the *Catalogus*, entitled *Fasciculus Stirpium Britannicarum, post editum Plantarum Angliæ Catalogum observatarum*, which, in addition to several rare Alpine plants from Wales and others from Cornwall, describes several new fungi, mosses and grasses and other plants, collected by Dale in Essex. Many of these had already been described in the two volumes of the *Historia*, although not in the *Catalogus*.

The records in the first and second volumes of the *Historia* are:—

- **Ahnfeltia plicata* J. Ag.
- **Halidrys siliquosa* Lyngb.
" *Conserva palustris*."
- **Lunularia vulgaris* Michel.
- Potamogeton interruptus* Kit. var. *scoparius*.
- **Ruppia rostellata* Koch.
- **Atriplex littoralis* L. var. *serrata* Moq.
A. laciniata L.
- **Hypochæris maculata* L.
- Peucedanum officinale* L.
- Bupleurum tenuissimum* L.
- Cynoglossum germanicum* Jacq.
- **Mentha rotundifolia* Huds.
- Damasonium stellatum* Pers.
- **Sisymbrium irio* L.
- Lepidium latifolium* L.

- Thlaspi arvense* L.
 †*Papaver dubium* L.
Lathyrus hirsutus L.
 **Viola hirta* L.
Allium oleraceum L.
 **Agropyron junceum* Beauv.
Polypogon monspeliensis Desf.
Calamagrostis epigeios L.
 **Carex distans* L.
 †*Carex divisa* Huds.
 **Prunus insititia* Huds.

Of these those that were new to the county run as follows:—

p. 71. *Alga exigua dichotomos, arenacei coloris* . . . Circa Hollandiam pagum non longe ab Harvico in littus maris rejectum invenimus.

On reference to specimens in Buddle's and other Sloanean collections this proves to be *Ahnfeltia plicata* J. Ag.

p. 73. *Fucus angustifolius vesiculis longis siliquarum æmulis*. Quem in littus ejectum invenimus circa Hollandiam vicum non procul ab Harvico portu, 5 trans *S. Osithæ* oppidulum milliaribus in Essexia."

This appears from specimens in the same collections to be *Halidrys siliquosa* Lyngbye.

p. 126. *Lichen sive Hepatica lunulata* επιφλοκάεστος . . . in umbris uliginosis. . . . D. Dale pharmacopæus & medicus Brantriæ, vicinus noster, Botanicus studiosus primus detexit nobisque ostendit non longé a domicilio nostro. [*Lunularia vulgaris* Michel.]

p. 190, following the description of *Potamogeton interruptus* var. *scoparius*, "*Potamogeton maritimum pusillum alterum*. . . ." "In fossis palustribus viâ a Camaloduno ad Goldhanger."

This, as represented in the Sloane Herbarium, is *Ruppia rostellata* Koch, as also is Plukenet's specimen (Herb. Sloane 97, 121), figured by him (under this name of Ray's) Tab. CCXLVIII., Fig. 4. In Gibson's *Flora*, Mr. Newbould suggests that the specimens used by Sowerby for *English Botany*, Tab. 136, as *R. maritima* are this species. "They were," he says, "from a plant gathered by E. Forster in Ray's station." Sowerby's drawing is, however, endorsed "E. F., junr. The habitat mislaid," while the specimens themselves are fragmentary and inconclusive. Edward Forster's own specimens in the British Museum Herbarium, both from Goldhanger, July 21st, 1793,

and from Maldon, are *R. spiralis* ; but Syme, in 1867, found both species growing together at Walton-on-Naze. He writes of *R. maritima*, i.e., *R. spiralis* (*London Bot. Exchange Club Report* for 1867, p. 13) :—" It seems to be later in flowering than *R. rostellata*, which grew with it, as it was in flower while *R. rostellata* was in seed."

p. 193. *Atriplex angustifolia maritima dentata*. In palu-tribus salsis prope Camalodunum . . . copiose. [*Atriplex littoralis* L. var. *serotina* Moq.]

p. 244. *Dens leonis foliis integris, caule raris foliis vestito*. Invenit & ad nos attulit D. Dale in colliculis seu tumulis olim aggestis juxta Baultoviam vicum in extremis Essexiæ limitibus Cantabrigiam versûs. [*Hypochaeris maculata* L.]

p. 532. *Mentastrum folio rugoso rotundiore spontaneum, flore spicato, odore gravi* J. B. Horse-Mint. . . . Spontaneum observavi in prato quodam, aquoso loco prope Faulkourn-hall . . . copiosè. [*Mentha rotundifolia* Huds.]

p. 811. *Erysimum latifolium Neapolitanum* Park. . . . *Irio lævis* *Apulus Eruce folio* Col. Smooth broader-leaved Hedge Mustard . . . circa ædes D. Edv. Bullock Ar. Faulkourn prope Withamiam. [*Sisymbrium irio* L.]

p. 856. *Argemone capitulo longiore glabro* Moris. prælod. . . . in vicinia nostra invenit & ad nos attulit D. Sam. Dale, vicinus & amicus noster qui Brantriæ pharmacopæiam & medicinam exercet, rei Botanicæ, apprime gnarus [*Papaver dubium* L.]

This forms part of the first British record of the species, Peter Dent having found it in Cambridgeshire, about the same time.⁴ Morison's name in his *Prælua* (1669) is only a name.

p. 1051. *Viola Martia major, hirsuta, inodora* Moris. D. Plot *Viola Trachelii folio nonnullis* . . . a D. Dale observata est in Essexia ad dextram viæ Tilburie Claram Suffolciæ oppidum ducentis, prope Tilburiam : item in via quadam umbrosa Ovinton & Belchamp S. Paul disterritante & a Noal-green in Parœcia Belchamp prædicta ad Claram ducente ad dextram. [*Viola hirta* L.]

p. 1119. *Allium sylvestre bicornè, flore ex herbaceo albicante. cum triplici in singulis petalis stria atropurpurea*. . . . Invenimus inter segetes Notleæ in Essexia Augusto mense florentem. [*Allium oleraceum* L.]

This "Wild Garlick with an herbaceous striate flower," as Ray terms it in the *Fasciculus*, is there more precisely localized as "*In a cornfield in Black Notley, Essex, belonging to the Hall, called westfield adjoyning to Leez-lane plentifully.*"

pp. 1255-6. 3. *Gramen caninum longius radicalatum marinum alterum* Lob. in maritimis Merseiæ insulæ prope Colcestriam nuper invenit nobisque ostendit D. Dale. [*Agr. pyron junceum* Beauv.]

p. 1295 10. *Gramen cyperoides spicis parvis, longissime distantibus*. . . . Hanc speciem primus mihi ostendit D. Martinus Lister, postea ipse observavi

⁴ W. A. Clarke, *First Records of British Flowering Plants*, 2nd ed., p. 7.

loco putrido & palustri prope molendinum *Machins mill* dictum sesquimillari a Witham oppido versus Camalodunum. [*Carex distans* L.]

p. 1296. 4. *Gramen cyperoides ex monte Ballon spica divulsa* J.B. In pratis prope Witham Colcestrensem in Essexia. [*Carex divisa* Huds.]

p. 1528. *Prunus sylvestris, fructu rubro acerbo, & ingrato*.
The black Bullace-tree.

A D. Dale observata est hæc arbor in sepibus secus viam publicam, uno minus milliari trans oppidum Chelmesfordiam versus Brantiam in Essexia. Item propè Bocking vicum, ad viam quæ inde Coggeshalliam ducit. Tandem ad dimidii milliari distantiam a Clara Suffolciæ oppido itinere Brantiano, in sepibus. [*Prunus insilitia* Huds.]

Of some 150 species described in the "Fasciculus," 20 are from Essex and most of these are due to the observations of Dale. They are:—

Allium oleraceum, as above.

Atriplex littoralis serrata, "Narrow-leav'd Sea-Orrache, plentifully by the river, and on the banks of the marshes about Maldon and elsewhere."

Atriplex laciniata, "Jagged Sea-Orrache. On the Sea shore near little Holland in Essex, found also by Mr. Dale in the Isle of Mersea, not far from Colchester, plentifully."

**Filix saxatilis ramosa maritima nostras*. Branched stone-fern
Mr. Newton once found it in a Well at Maldon in Essex."

This appears to be a young seedling of *Pteris aquilina* L. Such seedlings growing in the chinks of damp walls have, as Messrs. Trimen and Dyer point out,⁵ a delicate appearance very unlike the usual form, and are barren."

Halidrys siliquosa, as in the *Historia*, quoted above.

Ahnfeltia plicata, here styled "Fucus," instead of the "Alga" of the *Historia*, and stated to have been found "propè Walton" instead of "circa Hollandiam."

Agropyron junceum Beauv., as in the *Historia*, quoted above.

Carex distans L., as in the *Historia* quoted above.

Carex divisa Huds., as in the *Historia* quoted above.

Gramen exile duriusculum maritimum Hist. nost. p. 1287, Small maritime hard grass. In arenosis maris littoribus. I found it on the Essex shore by little Holland between Walton and S. Osythe. [*Festuca rothballioides* Kunth]

Lunularia vulgaris, as in the *Historia*.

Lichen sive Lactuca marina tubulosa Hist. nost. p. 77. "In fluviis & fossis majoribus quas mari singulis æstuum accessibus influit: Prope Camalodunum in Essexia observata." [*Enteromorpha intestinalis* Link.]

Silene anglica L. "Mr. Dale hath lately discovered among Corn in Essex. He takes it to be the *Lychnis arvensis minor Anglica* Park., found among the Corn near Colchester."

⁵ *Flora of Middlesex*, p. 342.

Mentha angustifolia spicata C.B., *spicata folio longiore, acuto, glabro nigriore* J.B. *Romana* Ger. *Romana angustifolia sive Carduica* Park. Spearmint or Heart-mint. *Hujus odor gravior est & in jucundior multo quam Menthae cardiacaë in hortis cultaë.*" [*Mentha viridis* L.]

"*Mentastri aquatici genus hirsutum spica laxiore*, J.B. *Mentha palustris folio oblongo*, C.B. *Mentastrum minus*, Ger. *emac. hirsutum* Park. Hairy Water-mint with a loose spike, and long leaf." [*Mentha pubescens* Willd. var. *palustris* (Sole).] Both found by Mr. Dale, beside Bocking River in Essex, the one a little above the Fulling-mill, the other below it in two or three places."

"*Orchis anthropophora oreades* Col. *anthropophora oreades femina* Park. . . . Man-Orchis with a green or ferruginous flower. Found by Mr. Dale in an old gravel-pit at Dalington near Sudbury in Suffolk." [*Aceras anthropophora* R. Br.]

This, as may be seen from the herbaria of Dale and Andrews is a mistake for "Ballingdon," on the Essex side of the Stour. The mistake is corrected in Andrews's handwriting in his copy of the Dillenian *Synopsis*, now in the possession of Mr. W. A. Clarke, also on one of Dale's tickets to one of the three specimens of this species from his herbarium now in the British collection at Cromwell Road, and by Ray himself in Gibson's *Camden*, p. 361.

Papaver dubium. "Mr. Dale shew'd it me in our neighbourhood at Bocking."

Ruppia rostellata, from Goldhanger, as in the *Historia*.

Prunus insititia. "Observed by Mr. Dale in some hedges both in Essex and Suffolk."

Viola hirta. "Found by Mr. Dale in Essex and Cambridgeshire in several places."

[To be continued.]

ADDITIONAL NOTES ON TREE-TRUNK WATER-PIPES.

By T. V. HOLMES, F.G.S., F. Anthropol. Inst.

WHEN collecting the information about Tree-trunk Water-pipes, which has already appeared in the *ESSEX NATURALIST*,¹ I was much struck by the great difficulty of foreseeing where they were likely to be mentioned, or who might possess any knowledge of them. As a consequence of the publication of my remarks, I have learned some additional details about them from various sources. And considering the oblivion which so soon enshrouds obsolete contrivances when the last generation which knew, and used them, has passed away, they seem worth adding to those already given.

In the first place, my friend, Mr. W. Whitaker, F.R.S.,

¹ Vol. xlii., pages 60-75 (July, 1903).

remembered that he had an old book which probably contained something about these pipes, and was good enough to send it to me for perusal. This book is one which, if exhibited on a book-stall, might well seem to the geologist or engineer too much out-of-date, to the archæologist not old enough, to be worth buying. It is styled *Hydraulia*, and was published in London in the year 1835, the author being William Matthews, author of *The History of Gas Lighting, &c.* He describes "The Water Works of London, and the Contrivances for supplying other great cities in different ages and countries." As regards wooden water-pipes, though they are mentioned not infrequently, their shapes and mode of formation are nowhere described, doubtless because our author considered it a needless and useless task to enlarge upon the familiar but obsolete.²

On pp. 33-34 some account is given of the development of a water company for supplying a part of Westminster. The works were begun in 1691. In 1812 the proprietors took up the whole of the wooden pipes and put iron mains in their place. The district is now supplied, says Mr. Matthews, by the New River and other companies. We learn that the London Bridge Water Works suffered from the competition of the New River Company, partly through the better quality of the water of the latter, and partly because the New River Company had laid down iron pipes, while nearly the whole of the London Bridge Company's pipes were of wood, and consequently "incapable of sustaining the pressure necessary for conveying water into the higher stories of many houses, even in situations where the water-wheels had sufficient power to force it to the required altitude." An additional circumstance, hostile to the continuance of the London Bridge Works, was the fact that when the other companies were laying down iron pipes the erection of the New London Bridge was in contemplation.

In the account of the development of the New River Company are many remarks on the disadvantages of wooden water-pipes (pp. 66-70). They are said to be generally of elm, a soft and porous kind of timber, a great part of the pipes requiring to be changed every two, three, or four years:—

"At one period the New River Company alone had different trains of

² See notes by Mr. Dick, and extract from Evelyn's *Sylva*, in the previous part of E.N., for description of the process of making the pipes.—Ed.

wooden pipes, about 400 miles in extent; but every year, from one cause or another, it became necessary to take up such as were injured or defective, and lay down new ones, amounting to an average of twenty miles, so that in the course of twenty years the whole range was entirely removed."

Then the bore of the wooden pipes varied for the most part from three to six and seven inches, though a few near the reservoirs might be ten or twelve inches. This small size obliged the use of several lines of these pipes to afford a supply of water to places at a considerable distance from the reservoirs. Thus we learn, p. 67:—

"In 1810 nine trains were laid, side by side, along one street; and as various causes produced fractures which permitted the water to escape, when an accident of this kind occurred, it was often very difficult to ascertain the line that contained the broken pipe, or the precise place where the injury was sustained. Hence it sometimes happened that a leakage from a single pipe occasioned the examination of a great length of the whole range, so that it occupied the labour of weeks before the defect could be discovered. Besides, during the progress of these operations, the usual supply of water being interrupted, it generally gave rise to serious complaints. Instances have occurred of two or three hundred yards of a street being taken up, and several weeks elapsing before the workmen could discover the leaking place; which, exclusive of the loss of water, and every other consideration, occasioned an expense of £30 or £40 to the company. The quantity of water lost by fractures, &c., was estimated at about one-fourth of the whole that entered them from the reservoirs."

Hence, also, when a good supply of water was needed to extinguish a fire, it was seldom obtainable from wooden pipes. Our author is inclined to think that the introduction of iron pipes for gas-lighting probably led to their general adoption for water supply, though they had previously been used, to a very limited extent, for carrying water. As to the dates at which they came into general use, we are told (p. 68):—

"Although previous to the year 1810 the New River Company had placed in the earth wooden pipes, several hundreds of miles in length, yet during that period and 1820 the whole were taken up, and others, made of iron, substituted through the entire range of their district."

This change was a very costly one, but our author remarks that the greater strength and durability of iron pipes will cause them seldom to require either change or repair; and the disturbance of the streets, caused by the use of wooden pipes, be very greatly lessened. Thus, much annual expense will be saved by the Water Company, and much inconvenience and annoyance be escaped by the public.

It appears that the engineer of the Grand Junction Water Works thought highly of stone pipes. They were adopted,

but it became necessary to remove them, and substitute iron pipes, "though at that period some prejudices were entertained with respect to their affecting the quality of the water." The exact date of this substitution of iron for stone pipes is not given.

Of the Southwark Water Company we learn that "prior to this period (1820--22) the supply of water had always been conveyed through wooden pipes, but these were gradually taken up, and iron pipes of larger dimensions substituted."

We are told of the Lambeth Company's pipes:—

"The principal mains are iron: eighteen, twelve, ten, and nine inches diameter, though till lately a considerable part of the service pipes were of wood, but iron pipes have been gradually substituted for them, and this operation will continue till the whole consist of the latter material." (p. 125).

As we learn on p. 124, that the Lambeth Company obtained a certain Act of Parliament in 1834, the passage referring to the nature of the pipes used was apparently written in the year of publication, 1835. It would seem therefore that in London, south of the Thames, wooden pipes remained in use some years longer than on its northern shore.

Leaving the water-works of the London district, Mr. Matthews describes those of Liverpool, Manchester, Edinburgh, Glasgow and Greenock. The Manchester Company, we learn, at first tried wooden, and then stone, pipes. But the latter proved incompetent to sustain the pressure applied. The following remarks illustrate the general development of water supply in England in 1835 (p. 142):—

"General, as was formerly the practice, to obtain water for domestic and other uses from wells, by means of a windlass and bucket, or the aid of pumps, it has long been gradually declining in the great towns and cities of this country. By the establishment of waterworks in such as are most populous, the method of supplying it for domestic purposes has been simplified and facilitated. Norwich, Bath, Birmingham, Sheffield, and many other places, possess these contrivances to benefit their inhabitants; but as they resemble several of those already described, both in principle and operation, any particular detail of each will be unnecessary. The defective supply of water to Exeter had long been a subject of complaint; however, a project has recently been executed for abundantly conveying water to the residents from the River Exe, so as to obviate the serious inconvenience heretofore experienced. Indeed, it is far from being improbable that, ultimately, works of a similar nature will be quite as common as those for the supply of gas."

Our author then describes the various modes of water supply in use, in times ancient and modern, in Athens, Rome, Cairo, Persia, and many other places outside the British Isles. For my

present purpose, however, it is enough to note that he remarks (pp. 200-1) that the ancient Romans used "pipes of lead, of wood, or even of earthenware." Also that the leaden pipes "were not cast tubular, as at present, but consisted of thin plates of lead bent up into the form of a cylinder, and soldered along the edge."

We thus gather from our author, a man qualified to speak with authority, that down to the year 1835 even our larger towns were by no means necessarily supplied with waterworks. And we may therefore confidently assume that our smaller towns were then almost invariably devoid of them, apart from the fact that none are mentioned as possessing any. We may gather from *Hydraulia* that probably a chief reason for slow progress in the spread of waterworks throughout the country lay in the indifference of their advocates to the appearance of the water they supplied from the rivers, which must usually have seemed inferior to that afforded by the shallow wells. On the other hand, the possibility of sinking deep wells, with anything like certainty as to satisfactory results, became evident only as a knowledge of the geological structure of the country slowly progressed. And this knowledge was but in its infancy in 1835.

The author of *Hydraulia* makes many remarks on the purity of water and its filtration. When speaking of the Lambeth Company's supply from the Thames, and its liability to be rendered turbid by mud and other matters, he adds:—

"Though turbid water be offensive to the sight, experience has satisfactorily proved that it is not injurious to health; nevertheless, perfectly clear and limpid water being preferable for beverage, and indispensable for washing and various other domestic purposes, all the water companies will probably adopt some decisive means for purifying and rendering it thoroughly clean, so as to convey it in that condition to the inhabitants. The period may not be far distant when the inhabitants of this great and populous metropolis will perhaps have the advantage of generally receiving *filtered water* for their chief domestic uses, successful experiments having demonstrated its practicability. Besides the increasing taste for cleanliness, other circumstances require that improvements shall adapt its condition to the wants and habits of the age, and therefore its supply should be as pure and transparent as its nature will admit."³

At the same time he evidently looks upon the mere desire for "transparent" water as a beverage as a squeamish weakness. He remarks (p. 324):—

"When cattle go to a clear stream to allay their thirst they often abstain from drinking till they have rendered the water turbid by stirring up the sediment with

3. From a note on p. 327 we learn—"In several recent Acts of Parliament for improving waterworks, a clause has been introduced to compel the supplying of filtered water."

their feet. Will it be unreasonable to infer that nature teaches quadrupeds that in such a state it is not only *wholesome*, but actually *medicinal*?"

My own view would be that cattle, which usually find admission to a stream only where it is shallow close to the bank, and consequently where the muddy bottom is close to the surface, walk towards the centre in order to drink where the water is deeper and clearer, even though they make muddy the stream between the bank and their drinking place. How much light is thrown on the preference of the people of Page Green⁴ for their shallow well water over that supplied by the local water company, even in 1865, when we read these views on turbidity of an eminent advocate of waterworks in 1835.

In the case of the New River we learn that its purity suffered to some extent from the state of the criminal law in 1835:

"The New River, being an open aqueduct, has one attendant annoyance, which is the practice of bathing in it by persons contrary to the wishes and rights of the proprietors. To obviate its continuance, but without, at the same time, depriving those who might be desirous of enjoying the pleasure, several years ago the New River Company liberally offered to supply water gratuitously for the purposes of *free baths*, if they were erected for general accommodation at the public expense; but the offer was unavailing, though the convenience and utility of such an institution must be strikingly evident. The nuisance of public bathing is therefore improperly persisted in, from the company not possessing the power to punish individuals who may commit the offence, except by an action for trespass upon their property, and as the penalty imposed by the law is *transportation*, considerations of humanity have hitherto prevented the prosecution of the offenders."

The concluding chapter of *Hydraulia* is occupied with a description of various schemes then put forward for obtaining water from streams less polluted than the Thames at, or close to, London, such as the Verulam above Watford and the Wandle at Beddington. The author strongly disapproves of them as needless, and as calculated simply to cause great expense, and to injure the existing companies. As to the alleged deleterious nature of the existing supply, he says:—

"Various facts related in the preceding pages have shown the fallaciousness of the assertion that the refuse from different manufactories imparted deleterious qualities to the Thames, and perhaps no statement was ever less supported by rational and creditable testimony. It is indeed far from improbable that the substances, to which the term *refuse* was applied, have a tendency to promote the decomposition of *animal* and *vegetable* matters, and really operate to render the water pure and wholesome. If the water be turbid, it may not be either

4. ESSEX NATURALIST, Vol. XIII., p. 72.

filthy or noxious, and generally it becomes transparent in a short time, if kept still to allow the subsidence of the particles which occasion its opaque appearance," &c.

As regards wells as a source of supply, our author mentions them as giving but a limited and variable quantity of water, which, if more "transparent" than river water, was frequently much less wholesome. Thus, "the recent analysis of the transparent water from the Treasury pump at Whitehall shows it to contain extraneous matter to the amount of four times the quantity from the Thames at Hammersmith, and the filtered water from the Chelsea Works."

It is evident that the knowledge of the geological structure of London and the district around it available in 1835 was utterly insufficient to allow of the sinking of artesian wells there on scientific grounds. Indeed, the earliest work of authority giving the geological structure of the London district, with especial reference to artesian wells, is Prestwich's *Geological Inquiry respecting the Water-bearing Strata of the country around London, with reference especially to the Water-supply of the Metropolis*; published in 1851. In this work we find only one allusion to *Hydraulia*, and that is in a note on p. 9. Prestwich is there noting the names of books giving details of the construction of artesian wells. He mentions but one British work on that subject, adding that Matthews' *Hydraulia* does not treat of this question. But in this case the mere allusion to a book published 16 years before is evidence that *Hydraulia* was a standard work on the subject of water supply.

My object in quoting so much from *Hydraulia* on the turbidity and transparency of water is to bring into prominence one of the influences greatly retarding the adoption of waterworks in the first half of the last century, but hardly likely to suggest itself to us now. It is no exaggeration to say that the views on turbidity suggest rather those natural to the cook at a hotel or club, who found a feeling prevailing there that all soup but "clear" soup was disgusting and dangerous to health, than such as might be expected on clear water from an eminent advocate of waterworks. In short, we must bear in mind that shallow-well or pump water had the attraction of being usually clear, and that turbidity and most imperfect filtration, if any, was to be expected in 1834 from a waterworks' supply. Also that water from artesian wells was almost unknown for some years later.

We shall then realise why the diffusion of waterworks throughout the country depended so largely upon the diffusion of fright, resulting from the evident connection of shallow-wells with cholera and other epidemics, and, consequently, why there is such a lack of evidence of the use of tree-trunk water-pipes in small towns after they had been found inadequate in the greater centres of population. For, as we have seen, though iron pipes began to be used by the London companies in the years 1809-10, yet in the year 1835 the larger towns which had adopted waterworks seem to have been but a minority.

Mr. Whitaker, writing from Gosport, on August 19th, 1903, remarked that he remembered seeing some tree-trunk pipes in or near Tottenham Court Road about 50 years ago, and that he believed some were found at Southampton a few years ago, when he was living there, a specimen being preserved at the Hartley Institute. He also stated that on August 18th (the day before he wrote) he saw many in the High Street, Gosport. He added that Mr. E. T. Mildred, the Waterworks Engineer at Gosport, has seen them all along High Street, North Street, South Street, and Forton Road, but has been unable to trace their history, as they have nothing to do with any existing supply.⁵

Our President, Mr. F. W. Rudler, kindly informs me that a few years ago many old wooden water-pipes were visible in Piccadilly when the road was taken up. As a friend of his, Mr. James Paton, Curator of the Glasgow Museum, wished to have one, a pipe was procured and sent to the Glasgow Museum. Mr. Rudler also tells me that when attending the Southport meeting of the British Association this year he visited Liverpool on Saturday, and saw in the Museum there two tree-trunk pipes. They were labelled as old elm water-pipes used to supply Liverpool about the year 1800.

Mr. H. M. Klaassen, F.G.S., has been good enough to tell me that in the last year in which the late Professor A. C. Ramsay lectured on Geology, at the Museum of Practical Geology, Jermyn Street (1876), the road in Piccadilly was undergoing extensive repairs. He then saw many wooden water-pipes,

5. I am also indebted to Mr. Whitaker for the information, received some weeks later, that specimens of tree-trunk water-pipes are to be seen at the Parkes Museum of the Sanitary Institute, 74A, Margaret Street, London, W. [And it may be worth noting that in the recently published catalogue of the Guildhall Museum, page 160, there is the following entry:—"110-111. Water-pipes (two) wood. Constructed of the hollowed trunk of a tree—xvii. century—5 feet 3 inches in length, 9½ inches diameter one end, 8 inches diameter other. London."—Ed.]

which had been taken out of the excavations there, on the side of the road near the Piccadilly front of the Museum.

During some months of the present year (1903) excavations have been in progress in the roadway of London Street, Greenwich, for the laying down of electric tram-lines. On August 18th my wife informed me that some tree-trunk pipes had been exposed. On visiting the spot I saw some about 3 feet beneath the surface. A good specimen of one of the shorter pipes was sent up to my house, through the kind intervention of Mr. G. Jones, 21, London Street. I am also much indebted to Mr. Knock, 54 and 56, London Street, who showed me some good specimens which he had caused to be placed in his garden; and to Mr. E. J. Pearce, of 92, London Street, who informed me of the discovery of some more wooden pipes a few days later. All were found near the junction of London Street with Royal Hill. Mr. Jones was specially interested in these pipes, because he remembered seeing similar ones in the year 1870 in the neighbourhood of New North Road and in High Holborn, when the New River Company was laying down larger main pipes there. He also remembers hearing from relatives that a large number of these pipes used to be in the gardens of the Round House, Clerkenwell. The Round House was demolished between 50 and 60 years ago.

I am much indebted to my friend, Mr. R. O. Heslop, F.S.A., &c., of Newcastle-on-Tyne, for the following interesting details from the *History of the Water Supply of Newcastle-on-Tyne*, a pamphlet written in 1851 by D. D. Main, then Secretary of the Newcastle and Gateshead Water Company, and reprinted from the *Newcastle Chronicle*, 1851.

After alluding to a scheme devised by Peter Morrys in 1580 for supplying the City of London with water, Main remarks that a similar project was suggested for Newcastle in 1697 by William Yarnold, an enterprising attorney from Oxfordshire, "who came before the mayor and made a proposal for supplying the town with good and wholesome water." He obtained an Act of Parliament (1698-9) and power "to break up the pavement of the streets, and to lay down pipes of lead or timber for the supply of the inhabitants." Yarnold constructed a small reservoir at Coxlodge, and laid down a four-inch wooden pipe from Coxlodge across the Moor, through the town of Newcastle,

and across the bridge over the Tyne to Gateshead. "The length of this pipe was 5,430 yards, and it is said was purchased by Yarnold from a broken-up work in London, probably that of Peter Morrys, whose water-wheels in the arches of London Bridge were now becoming eclipsed by the bolder and more comprehensive schemes of Sir Hugh Myddelton."⁶

It seems most probable that the "broken-up work in London" was either that of the company formed in 1594 for supplying the western part of the City (*Hydraulia* p. 30), or that of the company formed in 1691 (*Hydraulia* p. 33) for supplying a part of Westminster. Both of these companies soon got into difficulties, while the London Bridge Works, as we have seen, were in full vigour at the beginning of the 19th century.

Mr. Heslop also tells me that :—

"In later times these elm tree pipes were made by the Incorporated Company of House Carpenters 'anciently called Wrights,' and the augers used in pipe-boring were preserved on the walls of their Meeting House in Newcastle until as late as about the year 1847."

I have already mentioned the great difficulty of foreseeing where information about wooden water-pipes may be obtained, or which persons are likely to possess any. Very recently it occurred to me that Mr. E. Woodall, of Oswestry, Shropshire, chief proprietor and editor of the *Oswestry and Border Counties' Advertiser*, was, of all men, perhaps the most likely to have noted their presence. For a special feature of his newspaper is a column devoted to "Bye-Gones," for which contributions are invited upon the Antiquities, Ancient Records, Old Customs, &c., &c., of Wales and the Border Counties. Yet, Mr. Woodall kindly informs me, in a letter dated October 1st, 1903, that nothing about tree-trunk water-pipes has appeared in "Bye-Gones," and that having looked through the index of *Archæologia Cambrensis* he finds no mention of them there. He has also no recollection of the discovery of any in the Border Counties. It would be difficult to mention anything which could more fully justify the collection of what is known about Tree-Trunk Water-Pipes.

⁶ Mr. Heslop tells me that he had the advantage of being able to search the Library of Mr. R. Welford, author of a *History of Newcastle*, for information on this subject, but could find only that given in Main's pamphlet.

APPENDIX.

The foregoing remarks were in type early in October, 1903. The following notes are the result of information received since that date.

In the first place, Sir John Evans, K.C.B., F.R.S., etc., kindly tells me (Oct. 20) that he saw tree-trunk water-pipes in use in Germany in the year 1839.

I am indebted to my cousin, Miss E. Graham, for the following remarks from the *Daily Mail*, of Oct. 26, 1903.

"Trees as Water Mains.—While some workmen in Newcastle (Staffordshire) were making some excavations at Penkull Street for the purpose of laying an electric light cable they made a most interesting find.

Two or three feet below the footpath they came across a number of trunks of trees, with a 5in. bore in the middle, and banded with iron.

It is asserted that between two and three hundred years ago these were used as water-mains. The wood was in a good state of preservation, and in some cases the bark was still attached."

It is evident from the above account that the former use of tree-trunk pipes for the conveyance of water is by no means a matter of common knowledge in Staffordshire.

Our Secretary, Mr. W. Cole, has been good enough to forward to me the following extract from the *Daily Mirror*, of Nov. 2, 1903:—

A Desirable Possession.—Mr. Myddelton, of Chirk, whose marriage to Mrs. Reginald Bingham took place on Saturday, is the owner of the oldest inhabited castle in England except Berkeley Castle. It possesses everything which an ancient castle should possess—dungeons, drawbridge, peacocks, sundials, and a ladies' garden, with grassy walks. The castle itself is built on a hill, and from its windows it is averred that fourteen counties can be seen. One of Mr. Myddelton's ancestors was Sir Hugh Myddelton, the founder of the New River Company, and one of the original wooden conduits is still preserved in the hall at Chirk.

Chirk is in Denbighshire, on the border of Shropshire, and about six miles north of Oswestry. The preservation of this "original wooden conduit" (even in a house inhabited by descendants of Sir Hugh Myddelton) suggests that such appliances were almost or wholly unknown on the Welsh Border in the time of James I.

I am indebted to Mr. J. L. Myres, M.A., F.S.A., for the information that he has learned from his uncle, a resident in Lancashire, that wooden water pipes were formerly common in

that county, many having been dug up here and there at various times.

And, as regards London, I am obliged to Mr. H. L. Kerdel, of the C.O.S. Office, Greenwich, who tells me that many tree-trunk pipes were unearthed in Bedford Street, Covent Garden, during the first week in November, 1903. Lastly, Mr. Whitaker informs me that, according to Dr. Mill, some wooden water-pipes were exposed in digging a trench along Dorset Street between Baker Street and Gloucester Place in 1903.

CHARCOAL-BURNING IN ESSEX.

By T. S. DYMOND, F.I.C., County Technical Laboratories, Chelmsford.

[*Read March 19th, 1904.*]

"At Thundersley, where there is much wood, part of the copse is cut at eleven or twelve years' growth into lengths of three feet for burning into charcoal. The burner is paid 20s. per 100 sacks, each of eight pecks; he does not cover the heaps with turf or earth, but with rushes, fern, thistles, long grass, weeds, or stubble which the master finds, but if the burner gets them he has 2s. per hundred more. He burns two heaps a week the year round, five cords in a heap; the master buys the wood at 14s. to 17s. the cord of twelve feet long, three-and-a-half high, and three broad. A team of five horses in a six-inch wheeled waggon comes every week from London and takes 200 sacks." *General View of the Agriculture of Essex*, by Arthur Young (1807), II., 147.

The details of the process of charcoal-burning in Essex as described by Arthur Young nearly a century ago remain true to-day, but the magnitude of the industry has gradually declined until now, probably, not one-third of the charcoal is produced in the whole county that was formerly produced at Thundersley alone. The causes of this decline are various. The disappearance of hop-growing and drying as an Essex industry and of the cutlery manufacture at Thaxted, for both of which charcoal was used, and the replacement of gunpowder by more powerful explosives have greatly diminished the demand for charcoal and, therefore, the price obtained for it, while the stubbing of the woodlands in the great wheat years, and the depression of agriculture since, which has resulted in the cutting up of the larger farms and estates, and the diversion of Epping Forest (where charcoal was largely burnt) to the purpose of a pleasure resort have all tended to reduce the output.

Yet, still, in the course of a ramble through the woods about

Ramsden and South Hanningfield or between Writtle and Blackmore, here and there will be found a cord of wood cut ready for burning and the blackened hearth on which the operation is carried out, hard by which will stand the simple hut in which the charcoal-burner lives when at work. A hundred years have made no change in his methods; abandoned and upturned by the side of a woodland drive near Ramsden may be seen the discarded still with which an attempt was made a



CHARCOAL BURNER'S HUT, WRITTLE WOODS.

few years back to resuscitate and revolutionize the industry by using a process in which the wood spirit, pyrolignous acid, and creosote could be recovered.

It is not my purpose in this note to describe fully the particulars of the charcoal-burning as carried on in Essex. I must refer those who are interested in the subject to the forthcoming volume of the *Victoria History*, treating of the Industries of the County, and I would also recommend a visit to Mr. Thomas Hunt, landlord of the "Windmill Inn," in the parish of

South Hanningfield, who has long been a vendor of charcoal and to whom I am indebted for most of the information I have been able to collect upon the subject. Near the inn is a hearth upon which charcoal is occasionally burnt.

Last autumn it was my good fortune to catch a charcoal-burner at work in the Highwoods near Writtle. The undergrowth had been cleared the year before and the copse poles cut into three-foot lengths and piled into cords of wood, but the hearth was far from any path, and, had it not been for the sunshine filtering through the autumnal foliage of the oaks and illuminating the smoke from the fire it would have been hard to find. The hearth was protected from the wind by a screen of bracken, built up between two oak trees, to a height of eight or ten feet. In the centre was the burning pile, already three parts burnt and sunk from a height of six feet, as originally built, to about four feet high. A pungent blinding smoke rose from the heap. Now and then the fire broke through the coating of hearth dust with which the heap was covered, revealing the glowing "coals" inside. Most of the surface was covered with a fungus-like growth, apparently a sublimate from the process of destructive distillation to which the wood was being subjected. Close by was a shovel and a heap of hearth dust for mending the apertures made in the coating by the fire breaking through, a ladder for reaching the middle of the heap, otherwise inaccessible, a heap of "brands," *i.e.*, the half-burnt ends of sticks found at the base of the heap when the burning is completed, and another of "charm" or small charcoal, both of which are used to start the next "fire," and lastly a tub for holding water and a pail for bringing it from the runnel near, the water being used for "quenching" the fire at the end of the process. A few yards away was the hut, which served as home to the charcoal burner when at work in the wood.

As one of the few survivors of an ancient craft, the charcoal-burner himself was an interesting personality. Skilled in all the details of the process, versed in the value for its various purposes of the charcoal produced from the different woods found in the Essex woodlands, and using the technical phraseology employed in the last paragraph, he seemed typical of a race of men that the last century has done much to annihilate. Though having a cottage at Billericay, he must yet live for weeks at a time beside

his fire in the woods wherever his services are wanted. His hut consists of copse wood poles arranged in a circle inclined to meet together at the top, with an aperture left for entrance, and the whole is made rain-proof by covering with turfs. Within is a couch of dry bracken and room for a fire, and here he lies at night through the severest weather.

Charcoal is, and always must be, a material widely used, and, unlike the now extinct potash industry, of which Dr. Laver gave an account in a former paper, charcoal-burning must always be carried on in well-wooded districts. Involving as it does the services of men who, for the practice of their calling, must possess individual intelligence and physical hardiness, it is to be hoped that along with the awakening interest in forestry, and the probable re-forestation of Essex land that ought never to have been cleared, it may again develop into a thriving industry.

THE ESSEX FIELD CLUB—REPORTS OF MEETINGS.

VISIT TO COLCHESTER AND THE WIGBOROUGH AND VIRLEY DISTRICTS.

MONDAY, APRIL 13TH, 1903.

Colchester, which in the past has been the scene of many pleasant gatherings of the Club, was on Easter Monday the rendezvous of yet another enjoyable meeting, the Club having reverted to the old custom of Bank Holiday excursions. The weather was fairly bright but keenly cold. The London-side members travelled down by the train arriving at about half-past ten, and at once walked up to the new Town Hall, where Councillor Guiney Benham very kindly conducted the party over the building, and pointed out and described the many interesting pictures, engravings, and art objects with which it is decorated.¹

Luncheon was taken at the "Cups Hotel," Mr. F. W. Rudler, F.G.S., President, in the chair, and at about half-past one the company started in a brake for Virley, under the leadership of Mr. C. E. Benham and Mr. J. C. Shenstone, F.L.S., the two members to whom the Club is indebted for the arrangement of the meeting. A considerable contingent of lady and gentlemen cyclists accompanied the party, and Dr. H. Laver, F.S.A., joined *en route*.

Despite a somewhat keen wind, the ride into "Mehalah-land" proved interesting. As the carriage rattled along, the occupants were afforded pretty views of the surrounding country, and over the brow of the hill past Wigborough there came into sight the dreary stretch of marsh-land, which showed that the

¹ See *Colchester's New Town Hall and Municipal Buildings*. By Wilson Marriage and W. Gurney Benham. 2nd edition. Colchester 1900.

end of the journey was near. In the midst are situated the two little villages of Virley and Salcott, which face one another from opposite sides of Salcott Creek.

At Virley the Rev. E. Musselwhite and Miss Musselwhite, who took great interest in the visit, joined the ramblers, and a walk of nearly a mile over the saltings, brought all to their destination, the site of the Red Hills on Copt Hall Marsh. To quote the excellent report of the meeting in the columns of the *Essex County Standard*, "here the marsh showed a large circular area slightly raised and composed of reddish earth plentifully strewn with fragments of primitive pottery. The rabbits of Wigborough had made the most of this oasis of light soil in the impenetrable clay desert of the marsh and their burrowings had served a useful purpose in exposing a good deal of the subterranean condition of things. Nettles, which appear to abhor a heavy soil as much as the rabbits do, had also found their opportunity and were growing profusely in this isolated circle of lighter earth."

"There is a story of Cuvier that when appealed to by the Academicians as to whether a crab might be defined as a red insect that walked backwards, he replied that the definition was an admirable one, and he could only make three corrections—a crab was not red, was not an insect, and did not walk backwards. In somewhat the same spirit it was cynically objected by one of the party that the red hills are neither hills nor red !

"Strictly speaking the objection is unanswerable, yet the name is not now to be altered, and an investigation of the interior of these strange remains of primitive times would show that the title is not so unreasonable as it would seem at first sight. The reddish earth and the really red pottery fragments of which they consist extend often to a depth of eight feet, at which the original substratum of London clay is reached, showing that the works are really mounds, though buried by the slow sepulture of time. Close by many of them, an actual mound, some feet in height, is often met with, the purpose of which must remain a mystery until either public or private munificence provides the necessary means for a thorough investigation of the interior. Dotted about on the marsh lands of Essex these red-earth hills are met with in no small number, and hundreds have been mapped out by the energies of the late Mr. H. Stopes and Mr. W. H. Dalton, and later still more completely by Dr. Laver, Mr. E. A. Fitch, and Mr. W. Cole, who have almost exhausted inquiry for the purpose of locating all the examples of red-earth hills that are known to exist in Essex."

The President, in the course of a few remarks, referred to the late Mr. Henry Stopes' address at a meeting of the British Association, on "The Salting Mounds of Essex"; and Mr. W. Cole said that all that seemed to be known of these mysterious mounds was contained in a contribution by the late Mr. Stopes to the *ESSEX NATURALIST*. Mr. Cole recounted various hypotheses which had been put forward to account for their existence. One explanation was that they were old salt works; but that was discountenanced by their position inland; whilst another view, supported by the fact that they were always found above high water mark, was that they were the sites of refuges made to protect cattle against floods. Mr. Cole, however, favoured the hypothesis that they were the sites of very early pottery kilns, for in them were found three or four kinds of pottery, some of which appeared to be Romano-British. He had brought over from the Essex Museum a selection of pottery which he had obtained in exploring Red Hills at Burnham (in company with Mr. Fitch) and at East and West

Mersea. These included some wedge-shaped pieces of pottery almost exactly similar to those used at the Doulton Works at the present day, and some "shovel-handle" shaped pieces of baked clay which further confirm the theory that the mounds mark the site of pottery works. There were also numerous pieces of finished pottery, some plain, some ornamented, showing by their form that the potter's wheel had been in use.

Dr. Henry Laver believed the "red hills" to be of much greater antiquity than was generally supposed, and mentioned that Celtic pottery had been dug out of one at Mersea. He pointed out that a complete knowledge of these mysterious remains was impossible until a thorough investigation of them had taken place, and suggested that application might be made to the British Association for a grant to help the work of exploration.

Mr. T. V. Holmes, Mr. C. E. Benham, and other members took part in the discussion. A few fragments of pottery were found, probably brought up to the surface by the rabbits, but time did not permit of any actual excavation work.

On returning to the Virley "White Hart" the brake was again occupied, and the return journey was accomplished through Layer Breton and Birch, where the party were most hospitably received by Mr. Douglass Round and by the Right Hon. James Round, M.P. (an original member of the Club), at the Hall, where the magnificent *Wellingtonia*, the vineries, and other objects of interest in the grounds were pointed out by Mr. Round. The old church ruin near the Hall was also visited, after which Mr. Round hospitably provided tea, which was a welcome refreshment for the visitors, on behalf of whom the President of the Club gracefully thanked the right hon. member.

The return train to London at 6.52 was duly reached, and so ended yet another very successful field-meeting in the Colchester district.

VISIT TO LAMBOURNE FOREST.

SATURDAY, JUNE 6TH, 1903.

THE object of the meeting was to explore the Lambourne Forest, which forms an important part of Mr. Buxton's scheme for the re-afforestation of Hainault. The visit last year, on June 14th, was marred by bad weather, and it was thought that the Members would be glad of an opportunity of inspecting at least a portion of the lands which are now practically secured and which will form such a grand addition to our natural open spaces. A sketch of the work of restoration was given in the April part of the *ESSEX NATURALIST* (*ante* pp. 25-29.)

The party assembled at the Grange Hill Station on the new railway from Woodford to Ilford, at about three o'clock. The walk was up Grange Hill to Chigwell Row, and across the Recreation Ground to that part of the recovered lands marked on the sketch-map as the "54 acres" field. Here the Forest keeper met the party, and shortly afterwards Mr. E. N. Buxton, who had come up specially from the educational meeting at Colchester to Romford, and cycled thence to the rendezvous to act as "Conductor," where his company was heartily welcomed.

A very pretty rambling route was then followed through the older woodlands to Cabin Plain, and so on to the open lands of Fox Burrows Farm. Here Mr.

Buxton explained what had already been done with regard to the planting of this wide expanse of arable land with seeds of forest trees and bushes. Mr. E. M. Holmes, F.L.S., who was of the party, examined the grasses at present growing on the land with the view to advising Mr. Buxton, and recommending what species should be sown so as to reproduce as closely as may be the natural sward of this part of the old forest.

Some striking woodland plants that could not escape notice were the handsome Wood-spurge (*Euphorbia amygdaloides*), the Earth Nut (*Conopodium denudatum*), and the Yellow Archangel (*Lamium galeobdolon*), all of which were very plentiful. Among the moths noticed were *Dasychira pudibunda* (the "Light Tussock Moth") and *Eurymene dolabraria* (the "Scorch Wing"), the latter uncommon insect being found by Mr. Dalton.

With regard to the geology and physiography of these parts of Hainault Forest, Mr. W. H. Dalton, F.G.S., made some notes, which he has kindly embodied in the following paragraphs:—

"Proceeding north-eastward from Grange Hill station, the gentle slope of London Clay is capped with a thin sheet of boulder clay, the most south-westerly fragment of that deposit in the county. At the pathway turning from the high road about a quarter-of-a-mile west of All Saint's Church, the boulder clay is replaced by loam for a few hundred yards, but recurs yet further eastward for nearly a mile. The route followed by the Club skirted this patch of drift on the south, passing alternately from it to the subjacent London Clay and back again, in the sinuous woodland path, and finally ascended a further rise of the London clay surface to the top of Cabin Hill, 300 feet above Ordnance Datum. This crowned by a spur of the Lower Bagshot Sands, extending from this point northward for a mile and a half. The fine, somewhat loamy sand, contained thin bands, cemented by oxide of iron into compact stone, whilst the bareness of the ground, and the presence of abundance of sorrel, suggested the continuation of the process by which iron-pyrites in the sand is slowly converted by contact with air and water to sulphuric acid and per-oxide of iron. A sample of this 'iron-pan' was secured for the Club's collection of rock-specimens."

"The broad landscape visible from the commanding position near Cabin Hill contained little to note of geological interest, except the sudden rise of Shooters' Hill, due to the great fault which runs along the Thames Valley from Greenwich to Erith, and thence by Laindon Hill to Tiptree Heath. Most of the intervening area, beyond the rather sharp fall of Cabin Hill, consists of gravel deposited by the Thames at various stages of its descent from the level of Fairlop and Barking Side to its present position, a lowering of its bed of nearly 150 feet. The gravel of North Kent, of corresponding age and level, contains enormous quantities of Palæolithic flint implements, evidently manufactured on the pebbly banks of the river, and probably the same will be found to be the case with the high-level river-gravels of Essex, when duly searched. But it must be laid down as a point of the greatest importance, that such implements be found actually embedded in the gravel, not merely lying in the surface-soil. Also, the level of site is of supreme value as fixing the approximate date, the lower terraces being necessarily far more modern than the higher."

The ramble was then continued through the upper part of the woodlands to the "Beehive Inn" at Lambourne End, where tea was served.

Afterwards an ORDINARY MEETING (the 222nd) was held, the President, Mr. F. W. Rudler, F.G.S., in the chair.

The President, in the name of the members present, cordially thanked Mr. Buxton for his efforts in the rescue of a large portion of Hainault Forest, and for his kindness in attending and explaining the position of affairs that afternoon.

Mr. Buxton briefly replied.

The following were elected members of the Club :—Mr. Edward J. Burrell, F.G.S.; the Rev. A. Bertram Hutton, Rector of Pitsea, Essex; and Mr. W. A. Sykes.

After some discussion of the observations of the afternoon, the homeward walk was taken through the woods, and so to the Grange Hill Station. Mr. Dalton reported :—

“In the evening walk to Crabtree Hill, a small pit in the Bagshot Sand was passed. This showed as much laminated loam as sand, attesting the gradual change in deposit from the London Clay up to the Bagshot Beds. Similar graduations attended the upward passage from the sandy and pebbly Woolwich and Oldhaven Beds into the London Clay. The somewhat arbitrary line taken as the base of the Bagshot series is marked by Lambourne Well, a spring in the wood, fed by the sands, and constituting the western feeder of the river Rom.”

SATURDAY, JUNE 20TH, 1903.

A meeting at the Walthamstow Reservoirs of the East London Waterworks Company had been announced for this afternoon, but the weather was very bad and uncertain for a week previously, and the Secretaries received hardly any intimations of intention to be present from members. It was found moreover that the flood-waters caused by the continuous rains had ruined the rivulets at the Reservoirs so far as collecting went. An immense quantity of lamp-black had been brought down from one of the factories on the Lea, and the aquatic vegetation was silted up with this unsightly refuse. At the last moment the meeting was abandoned, the second instance only of this being done during the life of the Club.

VISIT TO THE UPPER REACHES OF THE NEW RIVER.

TUESDAY, JUNE 30th, 1903.

THIS excursion proved to be a very interesting one, for by the kindness of Mr. J. M. Wood, M. Inst. C.E., one of the Engineers to the New River Company, the members had an opportunity of exploring some of the pretty country traversed by this miniature river.

In addition to Mr. Wood as conductor we had the advantage of the company of the President, and Mr. E. T. Newton, F.R.S., Mr. F. Enock, F.L.S., and of our Vice-President, Mr. T. V. Holmes, F.G.S.

In the early morning conveyances started from Woodford, calling at Chingford Station for some of the party and at Waltham Cross for the full complement.

The first stoppage was at Messrs George Paul's rose gardens at Cheshunt, over which the party was shown by a member of the firm. Then a short walk on the river banks, and the disused Cheshunt Reservoirs were reached. A boat and nets were in readiness, but the water was choked with weeds and was cold, the result of the heavy rains, and very little of interest was observed. The walk was

continued past Turnford Pumping Station, over Turnford Aqueduct, and through the parish of Wormley to Broxbourne. From the river banks, beautiful and extended views of the surrounding country were obtained, especially of the Lea Valley and the hills forming the western boundary of Epping Forest, while a number of charming pieces of New River scenery were passed on the ramble.

The New River, as nearly everyone knows, was constructed by Sir Hugh Myddelton, a goldsmith and citizen of London. The work of forming the conduit was commenced on the 21st April, 1609, and completed in 1613. The original source was Chadwell Spring, about $\frac{1}{4}$ -mile west of the town of Ware, in Hertfordshire, and the water was conveyed therefrom by a gravity conduit, following the contour of the country and terminating at the New River Head, in Islington.

The original length of the conduit was about 38 $\frac{3}{4}$ miles, and the fall was then computed to be about four inches to the mile, and the distance, as the crow flies, from Chadwell Spring to New River Head, is about 20 miles. The conduit in the early days was nothing more than a mere ditch when compared with the present channel. At a later date the conduit was extended in a westerly direction from Chadwell Spring towards the town of Hertford, where the supply was augmented by taking water from the River Lea. The present intake, now known as the New Gauge, is a floating weir. During the last century, and particularly towards the end, the conduit has been continually improved by increasing its sectional area, reducing its length by cutting off loops, forming embankments, tunnels and aqueducts, and by laying part of it in pipes, until at the present day its length from New Gauge to New River Head does not exceed 27 miles. The average sectional area is about 80 to 90 square feet, and the fall of the water surface from the intake on the River Lea to New River Head is about 20 feet, and from Chadwell Spring to New River Head about 15 feet, and the carrying capacity of the conduit is about 60 million gallons in 24 hours, the average velocity of the stream being about 1 $\frac{1}{4}$ feet per second.

A rest for lunch was made at the "Crown Hotel," Broxbourne, when an ORDINARY MEETING (the 223rd) was held, the President in the Chair.

Mr. H. W. Unthank, B.A., B.Sc., was elected a member.

On the motion of the President, a very cordial vote of thanks was passed to Mr. Wood, who had in the kindest way arranged the details of the meeting.

The river-side ramble was then continued, the banks being parallel with the Lea Navigation; the Stour Valley and Stanstead Church could be seen on the east, and Haileybury College on the high land to the west. Journeying onward, Rye Common Pumping Station was passed, when the River enters the "Wilderness," one of the prettiest pieces of wooded scenery on the river between London and Hertford; then past the quaint little Parish Church at St. Margarets to the picturesque village of Great Amwell, with its Church nestling on the western hillside, and over-looking Easneye Park and the Lea and Ash Valleys. At the foot of the hill, leading to the Church, are the old parish "Stocks."

At Amwell a strawberry tea was provided by Mr. Wood's hospitality, and then under his guidance the celebrated Amwell pond with its two islands, stone tablets and inscriptions, was visited; it was one of the early sources of the New River, and it is by far and away the most beautiful spot on the stream. Chadwell Spring, the original source of the New River, was seen at the foot of the chalk hills.

The party was driven back in the evening down the coach road to Ponder's End, and so to Chingford. The day was beautifully fine, and although the natural history results were very meagre, the excursion was greatly enjoyed by all taking part in it.

VISIT TO THE LIGHT RAILWAY BETWEEN KELVEDON AND TOLLESBURY, ESSEX.

SATURDAY, JULY 4TH, 1903.

THIS meeting was held in conjunction with the Geologists' Association, and was under the direction of Mr. T. V. Holmes, F.G.S., who has kindly furnished the following report :—

The visit was to that portion of the railway which lies between Kelvedon and Tiptree, by the kind permission of Messrs. Walter Scott and Middleton, the contractors for the line.

Its northern end is close to Kelvedon Railway Station, and its course, for about the first 300 yards, is close to the G.E.R. line, and on its southern side. Then the Light Railway crosses Feering Hill about 350 yards south-west of the junction with the road to Inworth and Tiptree, and ranges in a S.S.E. direction, westward of that road, as far as Tiptree.

The portion of the railway visited is wholly in Sheet 47 of the map of the Geological Survey, and near its south-eastern boundary. The first section observable after leaving Kelvedon Station was where the Light Railway begins to diverge from the G.E.R., and was in reddish gravel. This gravel was seen both north and south of Feering Hill, though chiefly northward. At one spot, near the northern end of this gravel-cutting, a little Boulder Clay could be seen beneath the gravel. This Boulder Clay is evidently a portion of the narrow band shown on the map of the Geological Survey in the midst of the post-Glacial gravel of the Blackwater Valley, which is traversed by the Light Railway at this point. In the *Memoir on Sheet 47* Mr. W. H. Dalton thus refers to it (p. 67).¹

"Between Feering and Kelvedon the gravel has been denuded in such a way that the Boulder Clay is exposed as a narrow belt skirting the brow of the hill."

Between Feering Hill and Domsey Brook this gravel was the only bed visible. And before leaving it, it may be well to note that on the day of our visit it was well shown, with the Boulder Clay beneath it, in the cutting on the G.E.R. Main Line, close to, but west of, Kelvedon Station, as far as Rolleylane Bridge.

Crossing Domsey Brook the party entered a cutting wholly in Boulder Clay, which had a length of about 400 yards. From a drain ranging from the northern end of this cutting to the alluvium of Domsey Brook it became obvious that the Boulder Clay extended downwards at least as far as the level of the brook. And the Director, when making some remarks on the local geology from a spot above this cutting, noted the following statement in the memoir on Sheet 47, bearing upon the depth probably attained by the Boulder Clay at this part of the new line. It refers to a brickfield close to the Inworth Road, about 500 yards eastward, and south of Domsey Brook (p. 62) :—

¹*Explanation of Sheet 47 of the Map (1-inch) of the Geol. Survey.* By W. Whitaker, W. H. Penning, W. H. Dalton, and F. J. Bennett.

"The 'Clay Pit' marked on the Ordnance map, between Feering and Inworth, is a brickyard, worked in Boulder Clay (the upper part whitish, the lower dark blue) to a depth of at least 30 feet. It is then not bottomed, and therefore the base must be some depth below the river, and the clay is probably continuous across the valley to Kelvedon, as at Witham, though overlaid by Valley Gravel in both cases. Between Feering and Witham, indeed, the Boulder Clay sinks down, cutting out the underlying Glacial Gravel, and resting on the London Clay."

Beyond this cutting, small drains beside the line showed Boulder Clay at the surface as far southward as a point due west of Inworth Church. Then south-west of the Rectory, at the south-eastern corner of a field the eastern hedge of which ranges close to, but west of, the railway, a Sarsen Stone was seen. And from this point, to that at which the Light Railway crosses the road from Inworth Grange and Windmill Hill to Tiptree, London Clay, with irregular cappings of gravel, appeared. The party did not proceed beyond the road just mentioned.

The London Clay near the north-western corner of Perry Wood showed septaria nodules with very high and irregular dips in a horizontal space of about 25 yards, suggesting the presence of one or more faults. As Mr. W. Whitaker remarked, the position of this spot is worth noting, as it may possibly turn out to be on the line of the Wickham Bishop or some other important fault. In Essex the absence of hard beds, and the very large proportion of the country which is covered by superficial deposits, make the detection of the direction taken by lines of fault a work of exceptional difficulty.

Of the gravel patches capping the London Clay hereabouts, the only one deserving special mention was seen between New Barn westward and Hill Farm eastward of the line. It was much coarser than the other patches, and contained many large flints.

The party returned to Kelvedon by the road from Tiptree past Perry's Wood and Inworth Church; and after tea at the "Sun Inn," on Feering Hill, caught the 7.35 p.m. train for Liverpool Street.

"More recent visits to this railway have shown me that by far the most interesting portion of it, from a geological point of view, is that between Tiptree and Kelvedon, noticed above. On descending from the Tiptree Heath plateau to Tolleshunt Knights and Tolleshunt D'Arcy, and thence eastward, nothing appears in the slight cuttings but London Clay, capped here and there by irregular deposits of gravel and sand.—T.V.H."

THE ANNUAL "FUNGUS FORAY."

SATURDAY, OCTOBER 24TH, 1903.

THE Fungus Foray was held on this day at the headquarters of so many former meetings of the kind—the "King's Oak" Inn, High Beach, Epping Forest.

The Botanical Conductors were Dr. M. C. Cooke, Mr. George Masee, F.L.S., and Mr. Arthur Lister, F.R.S.

The collecting parties were two—one starting about noon from the headquarters, and exploring Honey Lane Quarters and the western sides of the Forest, and the second from Loughton, visiting the ground by the Loughton Camp and Monks Woods.

The specimens collected during the day were arranged on tables in a room in the hotel, and named and labelled by the experts present.

Over 100 species were listed, including four new to the Forest Flora :—

Pleurotus columbinus

Hypholoma elaeodes

Clytophilus cancrinus

Russula densifolia

These were in addition to the species new to Britain, *Collybia planipes*, obtained previously in the Forest, on September 24th.

The collection of specimens was very interesting and instructive, and it is a pity that only one afternoon was available for the study of it.

Tea was taken at 5.30, and afterwards a meeting was held, the President, Mr. F. W. Rudler, in the chair. The President congratulated those present on a fine day, and very interesting meeting; they had only to look on the tables, with their wealth of specimens, to discover that the labours of their collectors had not been made in vain.

Dr. Cooke made a few remarks on the species gathered together on the tables, and then gave the following address on

EDIBLE FUNGI.

By M. C. COOKE, M.A., LL.D., A.L.S., &c.

Once again, and year by year, I think more seriously that it may be the last time that I shall face the Essex Field Club at their Annual Foray. Friends may flatter, and try to deceive, but at the same time they know, as well as I do, that the time has come when the chances rapidly diminish. Hence it is best to make the most of the present, and leave the future in "the lap of the gods!"

When asked what I should talk about on this occasion, I naturally replied that as one phase of our multifarious subject has come rather prominently into notice during the past few weeks, I should confine myself to a few remarks on "Edible Fungi."

I think I may venture, without undue egotism, to affirm that whatever I may know theoretically, I do know practically more on this subject than any other benighted islander of Great Britain, and possibly of Greater Britain. If I mistake not, it is more than half a century since that I was deluded and ensnared into the study of fungi through the stomach. I have heard it stated that if you want to find a way to a man's heart, you will have to approach it through the stomach. Practically this is very true, for if I had never paid a visit to a farm house, and been for a day or two in the company of an intelligent enthusiast, I might never have gone beyond the ordinary knowledge of fungi, represented by the power to distinguish a mushroom from a toadstool. On this memorable occasion I went as an ignoramus; but it was autumn, and I soon discovered the hobby of my host. He produced a number of coloured drawings to my astonished gaze, and informed me that all the fungi shown were good to eat. We strolled into a little wood the next day, and collected enough of the Parasol Mushroom for a meal, and at first, with some fear and trembling, I did eat and was filled. This first meal did its work, and I became a Mycophagist—a fungus-eater. As a memorial of the occasion the coloured figure of the "Parasol Mushroom," which was reproduced in the first edition of my *Plain and Easy Account of British Fungi* was a facsimile of the drawing, which proved to be the agent of my conversion from the error of my ways, and led me into the track which my feet have trod for half a century. Hence you will observe that I began the study of fungi, as so many

more have begun, with an appeal to the stomach, and, having commenced, it was not long before I was involved in the mysteries of the whole subject, and became a fungologist.

Some of my hearers may be curious to know what obstacles I had to encounter, and how I managed to surmount them. My country farmer was not acquainted with more than 20 or 30 species of fungi, so that he could do no more than give me a start, and show me Badham's book on the *Edible Funguses of Great Britain*. As for myself, I was living in Lambeth, and he was in Norfolk, so that mutual instruction was at an end.

How I got my early specimens I do not know, and the steps in my progress I do not remember. There was no "field club" in those days that I had any knowledge of, until I started the "Society of Amateur Botanists" with a subscription of five shillings a year, and then we went ahead.

You must take into account the difference between 1854 and 1903 in facilities for the study of such a difficult subject, of which all our best botanists were profoundly ignorant—and, except perhaps Sir William Hooker, and his friend Dr. Greville, unsympathetic. True there was the "facile princeps," the great luminary, then beginning to be recognized, the Rev. M. J. Berkeley, but he had written little, was rather unapproachable to students, and his satellites had not begun to shine.

The books which a poor and struggling student could have access to were very limited. All that I can remember, as of any service to me, were Berkeley's volume of Hooker's *English Flora*. The fourth edition of Withering's *Arrangement*, Badham's book, and the numbers of the *Gardener's Chronicle* after 1860.

There was certainly Mrs. Hussey's *Illustrations* and numerous continental works with figures, but practically no coloured illustrations available, until later years, except the volume by Badham: others cost pounds, instead of shillings. The two large coloured charts of Edible and Poisonous Fungi, by Worthington Smith, came like rain upon a thirsty land in 1867.

I can only ask you to compare the facilities which are offered to the student of fungi at the present time with what they were fifty years ago, for you to appreciate the difficulties and struggles which environed me when I first determined to attack and conquer this stubborn subject, or die in the attempt. But I did not die, although I tempted Providence by eating so many different "toadstools." Whether I succeeded in my conquest, it is not for me to judge, but I think posterity will acquit me of making a conspicuous failure.

It will be evident from what I have said, why I have always encouraged Field Clubs and individual wood-ramblers to interest themselves in Edible Fungi, but I am afraid that hitherto we have, perhaps, attempted too much at a time, and that, instead of pointing out 50 or 60 Agarics as edible, we should have been content to confine ourselves first of all to five or six species, and have them universally known and appreciated, before attempting others. There are no general rules by which an edible fungus can be distinguished at sight from a poisonous one. It is the same with flowering plants. There is no general rule whereby the novice may distinguish the foliage of Hemlock or Fool's Parsley from true Parsley, the root of Monkshood from Horseradish, or the red berries of a noxious from those of an innocuous plant. The only successful method is to become familiar with the plants themselves. Your country schoolboy, who has only just learnt his alphabet, knows a pigeon from a crow, and a blackbird from a

jackdaw; not by any general rules, but by individual knowledge. It is by a like method that grown-up boys must learn to distinguish, as unmistakably, some half-a-dozen good and sound edible fungi, so that they will know a Parasol Mushroom or a Chanterelle as well as they know a cock robin or a yellow hammer, or even a toad from a frog, which requires a little more discrimination.

I am beginning to think that, at these annual forays, if, instead of troubling ourselves with the Latin names of fifty or sixty different species, which are all forgotten in five minutes, we were to set ourselves every year to learn thoroughly how to distinguish and recognize three or four really good, and fairly common, species, we should do more good to ourselves, more service to the public, and more credit to our Society, than in struggling to compile a big list of ugly names, which represent no ideas to ninety-nine persons out of a hundred.

Allow me to suggest for the Essex Field Club a good half-dozen which are to be gathered in the Forest, and which would be a fair experiment to begin with, and give an impetus to fungus hunting for the rest of the season. Here would be a specific object, going in search of three or four well defined individuals, and not a mere scramble for everything that can be called a fungus, with no other ambition than to get a basket full.

You all know the Common Mushroom, and the larger Horse-mushroom, so that they need not to be included. Let us confine ourselves to the following:—

The Parasol Mushroom (*Lepiota procera*) easily recognised, and excellent when cooked.

The Ruddy Warty-caps (*Amanita rubescens*), very common, and, when young, before the cap is fully expanded, excellent eating.

The Chanterelle (*Cantharellus cibarius*), well known by its bright yellow colour, and fruity odour, but it requires careful cooking.

The Shaggy-caps (*Coprinus comatus*), with black gills and spores, soon melting away, so that it should be cooked as soon as possible. I am not the only one who considers this equal, as an esculent, to the ordinary mushroom.

The Fairy-ring Mushroom (*Marasmius oreales*) may be looked for in August, but seldom found in October. It should be hung up, and dried in the air, for use as a flavouring in soups and stews.

To these may be added, as a sixth, Hedgehog Mushroom (*Hydnum repandum*), with spines on the under side of the cap, instead of gill plates. As an esculent it is equally good with the rest, but not so agreeable to all palates, as it is rather pungent, and must be cooked slowly.

If you want to add another, let it be the Vegetable Beef-steak (*Fistulina hepatica*) which may be sliced and fried to make good gravy.

By this process we hope to accomplish something in the way of popular education in the identification of a limited number of edible fungi. Most of the members could distinguish an Oak, a Hornbeam, a Beech, an Elm, a Birch, or a Willow, and not be content to lump them all together as *Trees*; so also we aim at inducing them to recognize a Parasol Mushroom, a Ruddy Warty-cap, a Chanterelle, a Shaggy-cap, a Fairy-ring Champignon, a Hedgehog Mushroom, or a Vegetable Beef-steak, and not for ever be content to call them all Toadstools.

Further than this, when we are assured, and they are assured, that they know these few species with confidence, and can make no mistake, we may expect them to cook and eat them, and then to teach their neighbours and friends. Nor will they be content with this, but will soon become anxious to extend their patronage to other species, and perhaps some of them acquire such enthusiasm in the

subject, and discover so much more interest in an autumnal walk through the Forest, that they will insensibly drift into amateur fungus-hunters, and if here and there an ambitious spirit should develop into a real Mycologist, our little efforts will not be in vain, and we shall have our reward.

The President returned the thanks of the meeting to Dr. Cooke for his Address, and alluded to his long and valuable services in the cause of the study of Fungi, and to the aid Dr. Cooke had given to these annual meetings from the foundation of the Club.

Mr. George Massee, F.I.S., then gave a short but extremely interesting Lecture, entitled "Some points in the Life-history of a Parasitic Fungus," illustrating his remarks by a series of coloured drawings from his own pencil. The parasite treated of was one attacking the potato.

Some little discussion followed the lecture, and the President expressed the cordial thanks of the meeting to Mr. Massee and to the Referees and Conductors at the meeting.

The day was fine, but the recent rains had destroyed many fungi, and damaged others. Mr. Massee reported that earlier in the autumn he had never seen fungi so plentiful in the Forest.

THE 224th ORDINARY MEETING.

SATURDAY, OCTOBER 31st, 1903.

This, the first meeting of the winter session, was held, as usual, in the Physical Lecture Theatre of the Municipal Technical Institute, Stratford, at 6.30 p.m., Mr. F. W. Rudler, F.G.S., President, in the chair.

New Members.—Mr. Arthur T. Barnard and Mr. Oscar A. Steeds were elected members.

Smith Collection of Newspaper Cuttings relating to Epping Forest.—The Secretary exhibited two volumes of newspaper cuttings and other papers, which had been collected by the late W. G. Shakespeare Smith during the time of the active work of the old "Forest Fund" Association. Mr. Cole said that all the older members of the Club would much regret to hear the news of Mr. Smith's death. He and the late Sir Antonio Brady were the founders of the "Forest Fund," an association which did excellent work in the pioneer skirmishes for the preservation of Epping Forest, before the City Corporation entered the fight. The "Fund's" meetings were of the greatest service to the cause of the free Forest in directing attention to the sins of the enclosers, and in educating public opinion even after the commencement of the memorable legal suits of the Corporation. The volumes of cuttings had been given to Mr. Cole by Mrs. Smith, knowing the interest he took in the question, and Mr. Cole had much pleasure in placing the volumes in the little library at the Forest Museum.

Mr. Walter Crouch spoke of the historic value of the volumes, which contained reports of meetings and newspaper articles now practically unattainable. The books were unique. He proposed that the Club should pass a vote of condolence on the death of Mr. Smith. All who knew the history of the rescue of the Forest would most gratefully acknowledge the value of Mr. Smith's services.

Mr. Cole warmly seconded the vote of condolence, which was passed unanimously.

Uncommon Insects.—Mr. Cole exhibited the specimens of *Calosoma sycophanta*, *Sirex gigas* and *Locusta viridissima* recorded in the October part of the ESSEX NATURALIST (*ante*. p. 128), and made some remarks on the same.

Photographs of Fungi.—Mr. Somerville Hastings exhibited a very fine series of Photographs of Fungi, many taken *in situ* with natural surroundings. Mr. Hastings gave a running comment on the slides, pointing out the names of the species and any peculiarities in their modes of growth, etc. Very many of the Fungi had been photographed in Epping Forest, and others in Hadley Wood and localities near London.

Prof. Meldola expressed his admiration of the beauty of Mr. Hastings' photographs. He referred to the desirability of ascertaining the correct names of the insects frequenting Fungi, and of the necessity for observation in order to ascertain the function of insects with respect to the distribution of the spores of Fungi.

Mr. Paulson also referred to this last mentioned subject, and Prof. Boulger made some remarks on the beauty of the slides, but said that all must regret the absence of *colour*. Colour photography should be applied to the representation of Fungi.

Mr. Hastings replied to some questions concerning the methods adopted by him in obtaining the photographs. At the end of the discussion a cordial vote of thanks was passed to Mr. Hastings for his interesting exhibition.

Lecture.—Prof. G. S. Boulger, F.L.S., *Vice-President, E.F.C.*, then delivered a lecture entitled "Seed Dispersal," which was illustrated by a long series of lantern-slides.

The following was the syllabus:—The object of seed-production.—Analogies of vegetative methods of multiplication, with methods of seed-dispersal.—Non-adaptive cases of seed-dispersal.—Non-specialised adaptations.—The four chief means of dispersal and the corresponding adaptations: (a) mechanical ejection; (b) transport by water; (c) transport by air; (d) transport by animals.—The progressive specialisation and the geological date of dispersal.—Mechanisms.

On the proposal of the President, an unanimous vote of thanks was passed to Prof. Boulger for his lecture, and the meeting ended.

THE 225th ORDINARY MEETING.

SATURDAY, NOVEMBER 28TH, 1904.

The second meeting of the Winter Session was held as usual in the Lecture Theatre of the West Ham Technical Institute at six o'clock, Mr. F. W. Rudler, F.G.S., President, in the chair.

New Members.—The following were elected:—Mrs. C. M. Barnard, Mr. Thomas W. Reader, F.G.S., and Mr. J. Rogers.

Stone Implements, &c., from West Ham.—Mr. W. Cole exhibited some Palæolithic implements and a Neolithic "flake" from Grove Green Lane, Leytonstone, and an incisor tooth of wild boar, from an excavation 18 feet deep at the Abbey Mills, West Ham, which he had purchased for the museum.

Stone Axe from Doddington, Essex.—He also exhibited a polished stone axe from Doddington, which was figured and described by Mr. F. W. Reader in the *ESSEX NATURALIST* (*ante* p. 193).

Palæolithic Flake from Kelvedon, Essex.—Mr. W. Whitaker, F.R.S., exhibited and presented to the Club a Palæolithic "worked" flake, found during the excursion to Kelvedon on July 4th last (*ante* p. 249).

Varieties of *Helix Nemoralis*.—Mr. J. T. Winkworth exhibited a fine series of "varieties" of the "Girdled Snail," *Helix nemoralis*, mostly from the neighbourhood of Harlow, Essex, and made the following observations on the specimens :—

VARIATIONS OF *HELIX MEMORALIS* AT HARLOW, ESSEX.

The exhibit goes to emphasize the wide and handsome variations of the mollusc.

All the shells exhibited, with the exception of var. *olivacea* were gathered near Harlow, off the bank bordering the main road from Epping to Bishops Stortford.

The series consists of the following variations :—

- (I) Yellow—Ia yellow, with a single central black band; Ib yellow, with many black bands.
- (II) Red—IIa red, with single central red band; IIb red, with many black bands.
- (III) Whitish, with black bands varying in number.
- (IV) Whitish, with black bands merged, forming almost a black ground.
- (V) Pinkish or flesh-coloured.
- (VI) Olive; known as var. *olivacea*, of uniform rich olive colour.
- (VII) Single banded; band varying in width.

Helix nemoralis is remarkable for the absence of the normal number of bands, and the mollusc seems to assert its discipline of the pigmentary-glands with the increase of age up to the end of the shell depositing period, so that apologetic bands or beginnings of bands are in evidence near the lip while no suspicion of the lines are observable in the older parts of the shell.

On the other hand occasionally an extra line is seen, so that the normal 1, 2, 3, 4, 5, becomes 1, 2, 3, 4, 5, 6.

Many interesting facts forced themselves on one's attention while in search of these shells. As a rule they were well concealed in grass or among leaves, only discovering themselves freely after considerable rain. *Helix hortensis* on the other hand can *always* be found on leaves and stems of hedges or on stalks on grasses and other vegetation. I found it necessary usually, where any were to be found, to feel over all the low lying grass.

The yellow forms and yellow with varying bands, were common in dried grass, while the red or reddish-brown forms were found among dried leaves at the edges of woods. I have never yet found the yellow form among brown leaves, in copses or woods, nor the red form among the dried yellowish grass. I think it can be fairly held that the environment settled the lives of the pronounced colours, varying with the prevailing colour of the spot where the creature was found, so that the fittest in colour only survived, and *that* colour was likely to be pronounced in the young more and more with every succeeding generation.

Strange to say, but yet not wholly contradictory to this experience, all the shells exhibited came from *one* bank. The vegetation was quite mixed, consisting of dried leaves, grass, short hedge growths, tall thistles and many umbelliferæ. The bank was bordering a main road, and adjacent to a considerable village.

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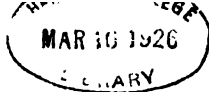
Please send post card or letter advising, with details of locality, etc., and address all to me at

The Essex Museum of Natural History,
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I have made several appeals on this page with no great results, but I do hope that now some aid will be given. It is impossible for one collector to work so large a district as ours, and besides the work of curatorship becomes more onerous every year, and leaves but scanty time for collecting.

WILLIAM COLE, *Curator.*

July, 1904.



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EDITED BY
WILLIAM COLE, F.L.S., F.E.S.,
Honorary Secretary and Curator.

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WILLIAM COLE,
Hon. Sec.

Generally, I found the absence of habitations went with the scarcity of snails. One can only think that the snails were protected from bird-life just in proportion as the birds dared not approach their habitat. Invariably, likely banks or edges of woods away from habitations were drawn blank.

The association of *Helix nemoralis* and *H. hortensis* is common, but there has never yet been recorded an observed marital alliance between them; though such pairing has again and again been surmised. Rimmer spent the spring and summer of 1878 in Normandy where *Helix hortensis* and *nemoralis* were in endless profusion, giving him an unusually favourable opportunity for observation, and the result was that not once did he see a marital alliance among the many hundreds of cases which he observed, a blackmouth (*nemoralis*) invariably pairing with a blackmouth and a whitemouth (*hortensis*) with a whitemouth.

A long and interesting discussion ensued, in which Mr. Whitaker, Mr. Miller Christy, Mr. Barnard, Mr. W. Cole, and Mr. Winkworth took part, and on the proposal of the President, a cordial vote of thanks was passed to Mr. Winkworth.

Mr. Winkworth said that he should have pleasure in presenting a series of variations of the shell to the Club's Museum.

Papers read.—Mr. T. V. Holmes, F.G.S., read a paper entitled "On some Greywethers at Grays Thurrock, Essex" (printed in *ESSEX NATURALIST*, *ante* pp. 197—202).

A discussion took place, promoted by Mr. Whitaker, Mr. Rudler, Mr. Thos. Reader, and the author, and Mr. Holmes was thanked for his paper.

Mr. Holmes having taken the chair, Mr. F. W. Rudler read his report as the Club's Delegate at the Southport Meeting of the British Association (printed in full in the *ESSEX NATURALIST*, *ante*, pp. 174—183).

A discussion took place, concerning the various matters brought forward at the Conference, carried on by Mr. W. Cole, Mr. John Spiller, F.C.S., Mr. T. V. Holmes, and the author, and the President was cordially thanked for his services as Delegate, and for his report.

THE 226th ORDINARY MEETING.

SATURDAY, DECEMBER 19TH, 1903.

This meeting was held as usual at the Technical Institute, West Ham, at 6.30 p.m., the President, Mr. F. W. Rudler, F.G.S., in the chair.

New Member.—Mr. W. A. J. Loveday was elected a member.

Photographs of Wooden Water-pipes in Situ.—Mr. F. W. Reader exhibited photographs of drawings in the Soane Museum, showing wooden water-pipes crossing the Fleet River in the fields at Clerkenwell, about the year 1800. (These drawings are reproduced and described by Mr. Reader in a paper in the present part of the *ESSEX NATURALIST*, pp. 272—4).

Mole's "Fortress."—Mr. Cole exhibited a model of the Mole's "Fortress," prepared from designs by Mr. Lionel E. Adams, which he had purchased for the Museum.

Lecture.—Mr. R. B. Lodge (author of *Pictures of Bird Life*, etc.) gave a lecture entitled "Some Pictures of Bird-life at Home and Abroad."

The syllabus was as follows:—At the Farn Islands—Sea Birds; The Spanish Marismas—Wading Birds; In a Danish Fyord—Wading Birds; In a Danish Forest—Black Storks, Buzzards, etc.

R

Mr. Lodge's lecture was illustrated by a multitude of exquisite photographs from nature taken in the woods, the fields, and the marshes by means of a long focus lens and a long suffering patience. These were shown by the electric lantern.

The President congratulated Mr. Lodge on the beauty and value of his photographs, and said that everyone present would agree in thanking him for a most interesting lecture.

Paper.—A paper entitled "Notes on the Report of the Essex Bird Society, 1903," by Mr. Francis Dent, Hon. Secretary to the Bird Society, was taken as read, owing to lack of time. (It was printed in the *ESSEX NAT.*, ante pp. 194—196).

THE 227th ORDINARY MEETING.

SATURDAY, JANUARY 30th, 1904.

This meeting took place as usual, at the Technical Institute, West Ham, at 6.30 p.m., the President in the Chair.

New Members.—Mr. T. E. Tawell and the Rev. F. G. D'Aeth were elected.

Implement of Bone from Braintree.—Mr. F. W. Reader exhibited a curious implement of bone which had been sent to the Museum by the Rev. J. W. Kenworthy, Rector of Braintree, who conjectured that the bone might have been used as a "cow-call" by blowing into it. Mr. Reader thought that this explanation required confirmation. They had nothing at all like the implement in the British Museum. Mr. Reader said that he would make further enquiries and report at some future time upon the object.

Eoliths from South Africa.—Mr. A. S. Kennard showed three Eolithic implements from Johannesburg, South Africa, and made some remarks on them.

Rhinoceros antiquitatis.—Mr. W. Cole exhibited a cast of the skull of *Rhinoceros antiquitatis* made by Mr. Damon from the specimen obtained from a frozen mud-cliff at the mouth of the river Lena, in Siberia. The cast had been purchased for the museum to serve as an illustration of the animal in the collection of the remains of Pleistocene animals.

Paper read.—Mr. J. Russell Larkby then read a paper entitled "Evidences of Prehistoric Man in West Kent." The paper was illustrated by maps, plans, and lantern-slides, and by a very large collection of specimens of Eoliths and Palæoliths from Well Hill, the North Downs, Aylesford, Hayes, Green Street Green, &c. All the specimens had been collected by the author. After reading the paper, Mr. Larkby gave a most interesting demonstration of this fine collection.

Mr. Larkby's paper will appear in a future part of the *ESSEX NATURALIST*.

A discussion arose, carried on by the President, Mr. Kennard, the author, and others.

A cordial vote of thanks was passed to Mr. Larkby for his paper and for his kindness in bringing at great trouble his remarkable collection for the inspection of the Club.

THE 228th ORDINARY MEETING.

FEBRUARY 13TH, 1904.

This meeting was held in the Technical Institute, Stratford, at 6.30 o'clock, the President, Mr. F. W. Rudler, F.G.S., in the chair.

As stated in the programme, this was a supplemental meeting in mid-month, arranged for Mr. Enock's lecture, which he had kindly offered to deliver to the Club.

New Member.—Mr. E. A. Bowles, M.A., F.L.S., F.E.S., was elected a Member.

Stoat in Winter Dress.—The Rev. A. Bertram Hutton exhibited a stoat or ermine in winter dress, remarking that as the subject of protective colouring was before the meeting that evening he thought that this specimen would be an appropriate object of interest. It is generally admitted that the stoat changes its colour to white in severe winter weather, in order that its coat may harmonise with the snow, and it may thus escape detection. It is thought that the white coat may come in two ways. It may change with the shedding of the hair—the new hair coming white; or, what is probably far more common in the British Isles, the actual brown hairs turn white when the snow falls. It is said that the change can be marked 48 hours after it has begun to snow. The specimen shown came from the Lake District, from a keeper living near Esthwaite. Since then Mr. Hutton had received three more from Scotland, the last being all white, and killed as late as March 26.

Professor Meldola, referring to this exhibit, said that he had formerly inclined to the opinion that the white colour in the winter stoat was the direct result of temperature, but he was now willing to accept the principle of Protective Colouring in this and similar cases.

[See the discussion on the change of colour in stoats in severe winters in the *Journal of Proceedings E.F.C.*, 1, pp. xi. and xii., and note by Mr. Christy, *Trans. E.F.C.*, 1, p. 67. The late Mr. English presented to our Museum a beautiful specimen of a white stoat from Epping Forest (*Jour. Proc.* iv., p. xcix), and another Essex specimen is in the Museum.—ED.]

Protective Colouring among Birds.—Mr. Hutton also showed some photographs and lantern slides illustrating this subject, the details of which are given in the "Notes" pages.

Peregrine Falcon.—And Mr. Hutton exhibited the Peregrine described among the "Notes," the bird being very skilfully set up by himself.

Hippopotamus tooth at Ilford.—The Secretary exhibited a fine Molar Tooth of Hippopotamus which had been dug up in Ilford Cemetery, about six feet down, probably from a stratum of brick-earth. The specimen had been presented to the Museum by Master E. H. Wiseman, of Forest Gate.

Rare Essex Books.—Mr. John Avery exhibited two very rare Essex books which he had recently acquired, viz., Gough's *History of Pleshy*, and one of Charles Clarke's publications, the *History of Great Totham*, the author's own copy, with MS. notes.

"King's Oak Inn," Epping Forest.—Mr. Avery presented to the Club, for the Forest Museum, an old print of the original "King's Oak Inn," at High Beach.

Lecture.—Mr. Fred Enock, F.L.S., F.E.S., then delivered a lecture on "Nature's Protection of Insect-Life," which was illustrated by about 60 lantern

slides, many of them being "natural colour" photographs of living insects, taken by the Sanger-Shepherd process.

The following was the syllabus :—

"Nature's many ways of protecting Insect Life—Hiding the eggs—Larvæ concealing themselves—Protective resemblance in colour, form, marking—Effect from different points of view—Terrifying appearance—Adaptation of colour to environment—Resemblance to living and dead leaves, twigs and bark—Value of Colour Photography."

The lecture and photographs were exceedingly interesting, not only as embodying the results of Mr. Enock's work during last summer, but also as a practical demonstration of the great value of the new process of photography in the study of natural history. In its rapidly improving form it is one of the most fascinating appliances ever placed in the hands of the naturalist. Some of Mr. Enock's slides were really startlingly realistic and beautiful, and brought home to the audience some of the facts of "protective resemblance" in a way which nearly equalled the sight of the objects themselves.

The President, in proposing in highly appreciative terms a vote of thanks to the lecturer, called upon Professor Meldola to make a few remarks, as being one of the highest authorities in this department of biology.

Professor Meldola spoke of the value, both artistically and scientific, of Mr. Enock's results. It only remained to increase the rapidity of the process, and to reduce the weight of the apparatus, to allow "Colour Photography" to be commonly and successfully pursued in the field. The possibilities of the process were almost infinite, and Mr. Enock was showing experimentalists the true path to success. Prof. Meldola said that he was inclined to agree with Mr. Enock that animals were, in a sense, conscious agents in producing some of the examples of protective resemblance. That was to say, that hand-in-hand with the development of physical agreement of colour, form, and markings, it was possible that psychical qualities might be developed which would induce the animals to actually seek places and attitudes of concealment corresponding to the colouring and markings on their own bodies.

Prof. Meldola concluded by calling Mr. Enock's attention to the case of the moth *Hybernia leucophearia*, which habitually rested on tree-trunks in such a position that the rugosities of the bark correspond with the lines of markings on the insect's wings.

The vote of thanks was passed with great applause.

Mr. Enock briefly replied, giving some details of his method of working, and said that the *Hybernia* was one of the cases he hoped to take an open-air record of in the early spring. Mr. Enock said that, should all go well, he would have great pleasure in laying his next summer's work before the Club in due time.

THE 229th ORDINARY MEETING.

SATURDAY, FEBRUARY 27TH, 1904.

This meeting was held in the Physical Lecture Theatre of the Technical Institute, Stratford, at 6.30 p.m., Mr. F. W. Rudler, President, in the chair.

Nomination of Officers and Council.—In view of the annual meeting nominations of officers and new members of the Council were made. (See report of the annual meeting on April 16th.)

Entomostracan from Epping Forest Exhibited.—Mr. D. J. Scourfield F.R.M.S., exhibited under the microscope a living specimen of *Diaptomus castor*. He remarked that it was not a very common species, but occurred in several places in the Epping Forest District. It was the largest of the British species and usually very beautifully coloured, the male being especially brilliant. Unlike the very common *D. gracilis*, which occurs practically in all pieces of water, except the smallest, *D. castor* only lived in very small pools, such as those found on the Leytonstone Flats, for instance.

A Supposed Pile-Dwelling at Woodham Walter, Essex.—Mr. Miller Christy, F.L.S., exhibited some flints cracked and calcined from fire, and some sandstone pebbles, soft and friable, from similar exposure to intense heat. These were from a deposit in a valley at Woodham Walter, and Mr. Christy gave some details which in his opinion indicated the former existence of an ancient pile-dwelling at this spot. The full account of Mr. Christy's observations appears in the present part of the *ESSEX NATURALIST* (pp. 280—2).

Mr. F. W. Reader and Mr. Kennard made some remarks on this subject.

"Pin-polishers."—Mr. Wilfred Mark Webb, F.L.S., exhibited two or three bone implements, commonly known as "Pin-polishers," and made some remarks on the same. Mr. Reader in his paper on "Pile Structures in the Walbrook" (*Archæol. Jour.* lx., pp. 137—204) gives figures and particulars of these implements, which have been found in some numbers in London. General Pitt-Rivers assigned them to the Roman level, but Mr. Reader has obtained specimens from Finsbury Square, associated with Tudor objects. Mr. Reader observes: "There seems no reason to doubt the use that has been assigned to these objects, as the grooves would serve well to hold a wire, and they all bear file-marks across the facets containing the grooves; some are filed down right into the internal hollow of the bone. At the present time the working jeweller uses a slab of wood upon which he holds the pins while filing them to a point. The edge of this slab is grooved in a similar manner to the squared portion of these bone objects. In nearly all instances the projecting processes at the natural end are knocked off, perhaps to allow of their being fixed in some manner."

Thanks were accorded for these exhibits.

Paper Read.—Mr. T. S. Dymond, F.C.S., read a short paper entitled "A Disappearing Industry: Charcoal Burning in Essex." The paper was illustrated by some lantern slides of photographs of Charcoal Burners at work.

A discussion took place on the paper, carried on by the President, Mr. Barnard, Mr. Shenstone, Mr. Christy, and others, and a cordial vote of thanks was accorded to the author. The paper will appear in the *ESSEX NATURALIST*.

Lecture.—Mr. F. W. Reader then gave a lecture on "Recent Observations and Discoveries concerning London City Walls, the Walbrook and Moorfields." The lecture was mainly a summary of Mr. Reader's two papers in the *Archæological Journal*, and one by Mr. A. S. Kennard, who was Mr. Reader's coadjutor in these investigations.¹

The Lecture was illustrated by about 50 lantern slides of old maps, engravings, objects of interest, and of the recent work carried on by Mr. Reader and Mr. Kennard at the site of the Walbrook, etc.

¹ "Pile Structures in the Walbrook near London Wall," and "Remarks on the Primitive Site of London." By F. W. Reader. *Archæol. Jour.*, lx., No. 238, pp. 137—204. "Observations on the Organic Remains and the Nature of the soil associated with the Pile Structures." By A. S. Kennard, ib., No. 239, Appendix to paper.

Mr. Reader and Mr. Kennard also exhibited a series of the antiquities obtained during the explorations.

It is hoped that an epitome of the lecture, so far as relates to matters of interest to Essex students, may be given in the *ESSEX NATURALIST*.

A hearty vote of thanks was accorded to Mr. Reader and Mr. Kennard, on the proposal of the President, who expressed his high appreciation of the value of the observations and of the care and skill with which the work had been carried out.

A short discussion and demonstration of the objects themselves was carried on by Mr. Rudler, Mr. Walter Crouch, Mr. Kennard, and the author.

Annual Meeting.—It was announced that the Annual Meeting could not easily be held in March, inasmuch as the only available date (26th) was fixed for the Students' Conversazione at the Institute. The Council, therefore, proposed to fix the meeting for April 16. This was agreed to by the meeting.

THE 24th ANNUAL GENERAL MEETING.

SATURDAY, APRIL 16TH, 1904.

The 24th Annual Meeting of the Club was held as usual at Stratford, Mr. F. W. Rudler, President, in the Chair.

The minutes of the 23rd Annual Meeting, held on April 4th, 1903, and printed in the *ESSEX NATURALIST*, Vol. xiii., pp. 86-7, were read and confirmed.

The Secretary read the Annual Report of the Council for the year 1903.

Mr. David Howard, J.P., the Treasurer, submitted the financial statements for the years 1902 and 1903. The former had been postponed from the last Annual Meeting for the reason then stated.

Mr. Howard made a few observations on the accounts, and expressed a wish that the adverse balance shown might speedily be blotted out. The most effectual way to do this was to increase the number of paying members to replace those lost by death and other causes.

Mr. Walter Crouch moved the adoption of the report of the Council and the Treasurer's financial statement, and this was seconded by Mr. T. V. Holmes, and carried unanimously. (The report and financial statements are printed in the present part, pp. 264-271).

The President echoed the wish of the Council and Treasurer that more young men of scientific tastes would become interested in the Club, and so enlarge the roll of members and particularly of "working members."

At the Meeting on February 27th last, the following Members retired from the Council by the Rules :—

Messrs. C. E. BENHAM, WALTER CROUCH, F.Z.S., F. W. ELLIOTT and I. CHALKLEY GOULD. They offered themselves for re-election, and were duly nominated.

AS OFFICERS for 1904 the following were nominated :—

President—Mr. F. W. RUDLER, I.S.O., F.G.S., F. Anth. Inst.
(late Curator of Museum of Practical Geology).

Treasurer—Mr. DAVID HOWARD, J.P., F.C.S., Pres.I.C.

Hon. Secretaries—Mr. W. COLE, F.L.S., F.E.S., and Mr. B. G. COLE.

Librarians—(Vacant).

Auditors—Mr. WALTER CROUCH, F.Z.S., and Mr. J. D. COOPER

No other members having been proposed for any office, the above gentlemen stood elected as Members of the Council and Officers for the year 1904 and were so declared by the Chairman.

The Hon. Secretary submitted the account of the Tea Fund for the session 1903-4.

Mr. J. Avery proposed a vote of thanks to the Officers. This was seconded by Mr. Reader and adopted.

The President then delivered his Annual Address, in which after some general matters relating to the Club he treated of "The Natural History of Pyrites and Gypsum, the chief minerals of Essex." [The address will be printed in full in a future part of the E.N.]

Mr. David Howard said that they would all thank their President for his most interesting and practically useful paper. Mr. Rudler had treated a most difficult subject in a most charming style.

Mr. T. V. Holmes warmly seconded the vote of thanks, which was carried amid applause.

Some remarks on the address were made by Mr. T. S. Dymond, F.C.S. Mr. Dymond's observations will probably be embodied in a paper to be read to be read to the Club.

The President briefly thanked the members for their appreciation of his efforts,

THE 230th ORDINARY MEETING.

This meeting was held in connection with the Annual Meeting, for the confirmation of the minutes of the meeting on February 27th last, and for other business. The President in the Chair.

Chislehurst Caves.—Mr. T. V. Holmes exhibited some photographs showing the interior of the Chislehurst Caves, which have recently been lighted up, and are now open to public inspection. They were (he said) in the hillside at the back of the Bickley Arms Hotel, and are about quarter of a mile from the Chislehurst Railway Station. Similar workings in chalk were once visible a little northward, at the western end of Camden Park, but are now closed to inspection, buildings having been erected in front of them. The valley through which the railway runs at Chislehurst, south of the tunnel, shows the chalk at the base of the hillside eastward. Above it are the Thanet Sand, Woolwich Beds, and Blackheath Pebble Beds. Except at this spot there is no chalk at the surface nearer than Lewisham northward, and south of Orpington, in the opposite direction. It has been worked at Chislehurst by means of galleries run horizontally into the hillside for some hundreds of yards. As the top of the chalk is but very slightly above the bottom of the valley, and as it appears at the surface only through the existence of a slight anticlinal fold in the strata, it is not surprising that the workers have here and there left too thin a roof of chalk, and have thereby caused a downfall of the overlying Thanet Sand. These falls of sand appear as conical mounds filling the gallery from roof to floor, and have necessarily caused the excavators to turn aside and alter the direction of the galleries near them, thereby introducing an apparent complexity. But there appeared to him (from what he had seen) to be no evidence of the existence of any vertical shafts where these falls occurred, or of any intersection of deneholes at their base. Then

in the excellent photographs showing the workings¹, they saw flat surfaces of chalk at a height of three, four or five feet above the floor. These surfaces of chalk were called by the photographer "altar-tables." He could not agree with the photographer on this point, as the probable explanation of these raised surfaces seemed to him to be in a wholly different direction. These galleries, when fully developed, were about 12ft. high. Here and there, however, were some 6ft. or less. Those now 12ft. high had once been much lower, their present height having been attained simply by lowering the floor. The so-called "altar-tables" were therefore (he thought) simply the remains of intermediate stages in the development of these galleries. And instead of there being any arrangement of the galleries leading up to these "altar-tables"—as might be expected on that hypothesis—they seemed to him to occur at odd corners here and there, just as might be expected if they simply marked stages in the excavation of the galleries. Nevertheless these Chislehurst excavations, if considered simply as workings for chalk, were extremely interesting, and well worth visiting, and he thought the public much indebted to those who had lighted them up and opened them for examination.

The Caterham Bourne.—Mr. Holmes also exhibited photographs showing the unusual amount of water lately flowing down the bourne in the usually dry chalk valley at Whytlesfe, near Caterham, Surrey, the result of the abnormal rainfall of last year (1903).

A paper by Mr. T. V. Holmes, F.G.S., entitled "On the Origin of the term 'Sarson Stones'" was taken as read owing to want of time. It appears in the present part of the *ESSEX NATURALIST* (pp. 275—9).

ANNUAL REPORT OF THE COUNCIL FOR THE YEAR ENDED DECEMBER 31st, 1903.

[Read and adopted at the 24th Annual Meeting on April 16th, 1904.]

FINANCIAL.—Mr. Howard's financial reports for the last two years are presented with this. The adverse balance is accounted for by the increase in the cost of the *ESSEX NATURALIST* for the past year, and in a falling off in the roll of subscribing members, consequent upon the lamentable number of deaths of old members of the Club. Many of these were original members, and as the Club is now entering upon its 25th year, it is but natural that such losses should occur. The Council considers that the working members of the Club have a just cause of complaint that their efforts are not sufficiently supported by residents in the county. In a large and populous district such as Essex, there are surely hundreds of persons who might reasonably be expected to join the Society. The common excuse, inability to attend the meetings, is surely not a point to urge against the Club. The Head-Quarters must be in some one spot, and Stratford is certainly the most accessible place of convenience of travelling from all parts of the County and the North and East of London is considered. And membership of a Society like ours (and it may be added, of our co-workers, the *Essex Archaeological Society*) surely should be put on higher ground than mere personal convenience. Well-wishers of the popularisation of natural science and archæology should determine to support the Society, as well as those residents

¹ Obtainable at the Bickley Arms Hotel.

who should join as a matter of county patriotism and good feeling. One-twentieth per cent. of the whole population of Essex would give the Club a membership sufficient for all the work that has ever been projected as coming within its scope and ability.

MEETINGS.—Six ordinary meetings were held during 1903, at which the papers, lectures, and other communications taken, fully sustained the scientific character of the Club. The Council have to thank Mr. D. J. Scourfield, F.R.M.S., for his lecture on the "Locomotion of Aquatic Organisms"; Mr. A. S. Kennard for a demonstration of a fine series of Flint Implements found in the Thames Valley; Mr. George Massee, F.I.S., for a lecture "On some points in the Life History of a Parasitic Fungus," Mr. Somerville Hastings for a lecture-demonstration of a very fine series of photographs of Fungi, taken by himself; Professor G. S. Boulger, for a lecture on "Seed Dispersal," illustrated by a series of lantern slides; Mr. J. T. Winkworth, for a demonstration of a very fine collection of "varieties" of *Helix nemoralis*, collected by himself mainly in Essex, and Mr. R. B. Lodge, for a lecture "Some pictures of Bird Life, at home and abroad," illustrated by a magnificent series of photographs from nature. Our President kindly acted as the Club's Delegate at the Southport Meeting of the British Association, and he presented a very full report of the proceedings of the Local Scientific Societies' Committee at our Meeting on November 28. This report has been published in the *ESSEX NATURALIST*.

The extremely unsettled weather during the greater part of last summer seriously interfered with the arrangement of Field Meetings, and on one occasion (June 20) it was found necessary to abandon the meeting at the last moment, after the circulars had been issued to members. At the Field Meetings the following gentlemen rendered essential service, and the Council beg to heartily thank them:—Councillors Gurney Benham, Mr. C. E. Benham, Dr. H. Laver, Mr. E. N. Buxton, Mr. W. H. Dalton, Mr. J. M. Wood, Mr. Paul, Mr. F. Enock, Mr. T. V. Holmes, Mr. E. T. Newton, F.R.S., and Mr. W. Whitaker, F.R.S. At the Fungus Foray on October 24, the Club was again favoured with the valuable expert assistance of Dr. M. C. Cooke, Mr. George Massee, and Mr. A. Lister, F.R.S.

Most welcome hospitality was accorded by the Right Hon. James Round, M.P., at his house, Birch Hall, on April 13, and on the enjoyable riverside excursion on June 30, by our member, Mr. J. M. Wood, C.E. We have also to thank our member, Colonel Bryan, C.E., for permission to hold the meeting at the Tottenham Reservoirs, which meeting was abandoned in consequence of bad weather, as above stated.

The best thanks of the Club are due to the Education Committee of the Corporation of West Ham, and to the Principal, Mr. Briscoe, for the use of the Meeting Rooms, and for many facilities in the conduct of the evening Meetings.

THE ESSEX NATURALIST.—The quarterly issue, announced in the last annual report, was commenced in April, and the Council venture to think it has met with general approval. Three parts were published within the year, comprising 160 pages, with six plates, two maps, and many other illustrations. The place of the January part was taken by the heavy part completing Vol. XII., which, though dated 1902, was really paid for in 1903, and which partly accounts for the extra cost of our journal in the latter year. The Council may point to the number and character of the papers, etc., printed, as a good reason for the

Treasurer's Statement of Receipts and Expenditure for the Year 1902.

Receipts.

To Subscriptions, arrears	£	s.	d.		£	s.	d.
" " 1902	By Deficiency from 1901
" " 1903	" Printing and Illustrating <i>Essex Naturalist</i>
" " 1904	" Printing Circulars and Stationery
" " 1905	" Postages of <i>Naturalist</i> and Circulars
" " 1906	" General incident expenses
" " 1907	" Library expenses...
" " 1908	" Lecture Fees
" " 1909	" Loss on Field Meetings
" " 1910	" Transferred to Essex Museum Maintenance Fund
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ESSEX MUSEUM MAINTENANCE FUND.

Receipts.

To Balance	82	6	5
" Corporation of West Ham	100	0	0
" Transferred from General Account	...	...	50	0	0
" Sale of Handbooks	...	...	0	16	5
			<u>£ 233</u>	<u>2</u>	<u>10</u>
By Salary of Curator, five quarters	...	...	...	...	...
" Curatorial expenses	...	...	...	...	...
" Balance	...	...	...	...	...
			<u>£ 233</u>	<u>2</u>	<u>10</u>

DEPPING FOREST MUSEUM FUND.

Receipts.		Expenditure.	
	£ s. d.		£ s. d.
To Balance	37 4 9	By Findings for Museum	1 10 6
" Donations and Subscriptions	20 13 0	" Printing	2 2 0
"		" Petty Expenses	3 11 3
"		" Balance	
	<u>£63 17 9</u>		<u>£63 17 9</u>

SPECIAL MEMOIR ACCOUNT.

Receipts,		Expenditure.	
	£ s. d.		£ s. d.
To Sale of Publications	0 16 8	By Balance, Deficiency	12 9 3
" Balance, Deficiency	11 12 7		
	<u>£12 9 3</u>		<u>£12 9 3</u>

BALANCES.

Receipts.		Expenditure.	
	£ s. d.		£ s. d.
To Essex Museum	30 17 2	By Balance at Bank	49 14 7
" For Essex Museum	3 11 3	" Less due to Secretary	2 9 8
" Life Compensation Fund	115 0 6	" Investments	47 4 11
		" Deficiency, General Fund	89 12 6
	<u>£149 8 11</u>		<u>£149 8 11</u>

Having examined the above Accounts with the books, vouchers, and Banker's pass-book, we find the same correct.

April 12th, 1904.

WALTER CROUCH }
JOHN D. COOPER } *Hon. Auditors.*

Treasurer's Statement of Receipts and Expenditure for the Year 1903.

[illegible]

Receipts.		Expenditure.	
To Balance	£ s. d.	By Salary of Curator...	£ s. d.
" Corporation of West Ham "	" Curatorial Expenses	120 0 0
" Transfer from General Account	" Balance in hand	39 4 8
			21 12 6
			<u>£180 17 2</u>

PEPPER FOREST MUSEUM FUND.

Receipts.		Expenditure.	
To Balance	£ s. d.	By Disbursements	£ s. d.
" Donations and Subscriptions	3 11 3	" Balance	14 10 3
" Sale of Tables	31 18 6		23 10 6
"	3 0 0		
"			
"			
	<u>£38 9 9</u>		<u>£38 9 9</u>

SPECIAL MEMOIR ACCOUNT.

Receipts.		Expenditure.	
To Sale of Publications	£ s. d.	By Deficiency	£ s. d.
" Deficiency	1 4 5		11 2 7
	9 18 2		
	<u>£11 2 7</u>		<u>£11 2 7</u>

BALANCES.

Receipts.		Expenditure.	
To For Museum	£ s. d.	By Bank Balance	£ s. d.
" For Museum	21 12 8	" Secretary's Balance	42 11 2
" For Compositions	23 15 6	" Investments	4 8 9
	115 0 6	" Deficiency	89 12 6
	<u>£160 3 8</u>		<u>£160 3 8</u>

Having examined the above Accounts with the books, vouchers, and Banker's pass-book, we find the same correct.

WALTER CROUCH, }
JOHN D. COOPER, } *Hon. Auditors.*

April 12th, 1904

Treasurer's Statement of Receipts and Expenditure for the Year 1903.

Receipts.

[illegible]

Receipts.

[illegible]

EPHING FOREST MUSEUM FUND.

Receipts.

To Balance	...	£ s. d.	Expenditure.	£ s. d.
" Donations and Subscriptions	...	3 11 3	...	14 19 3
" Sale of Tables	...	31 18 6	...	23 10 6
	...	3 0 0		
		<u>£38 9 9</u>		<u>£38 9 9</u>

SPECIAL MEMOIR ACCOUNT.

Receipts.

To Sale of Publications	...	£ s. d.	Expenditure.	£ s. d.
" Deficiency	...	1 4 5	...	11 2 7
		<u>9 18 2</u>		<u>£11 2 7</u>

BALANCES.

Receipts.

To Essex Museum	...	£ s. d.	Expenditure.	£ s. d.
" Forest Museum	...	21 12 8	...	42 11 2
" Life Compositions	...	23 10 6	...	4 8 9
	...	113 0 6	...	89 12 6
		<u>£160 3 8</u>		<u>£160 3 8</u>

Having examined the above Accounts with the books, vouchers, and Banker's pass-book, we find the same correct.

April 12th, 1904

WALTER CROUCH,
JOHN D. COOPER,

Hon. Auditors.

existence of the Club, and a justification for the appeal for a larger measure of support from all interested in the progress of science in Essex. The editor begs to repeat and emphasize his request made in last report for more "Notes" of original observations, which are always so welcome and encouraging.

THE ESSEX MUSEUM OF NATURAL HISTORY.—Substantial progress has been made at the Museum during the past year. Many new cases have been constructed and fitted up, and very great improvements have taken place in the mode of exhibiting the specimens, particularly in the substitution of rectangular glass jars in place of cylindrical ones, for specimens in fluid. Among the series that have been re-arranged are the fishes, the reptiles, and the Marine Invertebrata. In connection with the latter collection a large scale map showing the deeps and shallows of the British seas has been prepared by Bartholomew, of Edinburgh, and Miss Gertrude Woodward has made a series of eight large-scale drawings of the principal types. Many very interesting specimens have been obtained from the Marine Stations at Plymouth and Naples, and a part of Mr. W. Cole's specimens obtained in the Colne Estuary have been mounted.

One small room has been devoted to the illustration of such subjects as mimicry and protective resemblance, etc., in insects, and some very beautiful examples have been obtained from Swinhoe and Bastin. This collection is not yet finished. Some coloured drawings have been specially made for these collections by Miss Jane E. Cole.

Other zoological collections worthy of special notice are the fine series of models, specimens, drawings, and tablets, illustrating the ancestry of the horse—put up as an object-lesson in the facts of evolution; a series of specimens of the Cephalopoda, so arranged as to show the progress or decline of the various groups in geologic time, and to lead up to the exhibition of the species still living in Essex waters; also a series (not yet quite finished) showing the primitive forms of Vertebrates and the allied Ascidians, etc.; the Essex species as obtainable being exhibited in this series.

In the gallery of the Museum the mineral collection has been partly arranged in accordance with the printed catalogue prepared by Dr. Auden before his regretted resignation as head of the chemical department in the Institute. The students' series of fossils in the four inclined cases, which was commenced by Mr. W. H. Dalton, F.G.S., and which owed so much to his generosity both of specimens and valuable time, is being overhauled. The fine collection of fossils, presented to the Club by Dr. Horace Browne, F.R.S., has permitted great improvement in the selection of specimens, and the mode of labelling and arranging has been altered so as to make the series of use to biological as well as geological students.

The Council has great pleasure in acknowledging the very valuable services of Mr. Thomas W. Reader, F.G.S., in connection with the collection of typical rock specimens, now being prepared for exhibition in the table-cases on the right-hand side of the gallery. For some months past Mr. Reader has devoted two or three days a week to this work, and has, moreover, presented many specimens from his own collection, to go with the collections presented by Mr. Dalton and Dr. Horace Browne. It is hoped that the rock collection will be completed in the course of a few months.

On the botanical side of the Museum work is only commencing, and any remarks had best be postponed until next report. But the beautiful series of large original drawings of the principal groups of Essex plants, prepared by Dr. M. C.

Cooke, deserve special notice. These have been framed and hung round the walls of the gallery, above the series of wall-cases, which will contain the educational set of botanical specimens. The Museum is to be congratulated on having obtained such fine examples of the skill of one of the leading English botanists.

Mr. F. W. Reader still continues to give us the benefit of his knowledge and skill in connection with our small archæological series, and Dr. Frank Corner, Mr. A. S. Kennard, and Mr. J. P. Johnson presented very interesting specimens to the collection.

The Curator has much pleasure in acknowledging the patient and skilful work of Mr. Whitehead, the Museum Steward, in all departments.

It is hoped that in the coming year, arrangements will be possible for the better exhibition of the Essex series of Vertebrates, the Essex Invertebrates, the Herbarium and the Pre-historic collections. These matters are now being carefully considered.

The LIBRARY must be held over for notice in the next report. But one very interesting donation must be recorded. Our member, Dr. H. C. Sorby, F.R.S., is subscribing for a copy of the *Victoria History of Essex*, and the first volume has been received.

EPHING FOREST MUSEUM.—The anxiety concerning this institution, referred to in the report for 1902, still continues, and, indeed, is becoming acute. It is proposed to call a meeting of the members and of the Epping Forest Museum Committee at the Museum to consider the whole matter, and a special report will then be presented. A good deal of work has been done at the Museum during the year, particularly in finishing the cases, and in the entomological collections. The Lepidoptera have been re-arranged in a special set of cases by Mr. B. G. Cole. Mr. H. A. Cole has made a large number of frames for the cases, and for an orderly presentation of the group labels in the different sections. Glass jars have been purchased for the tree and fungi collection, and a set of small aquaria are in hand awaiting setting up. Mr. H. A. Cole has also made a stand for jars to contain specimens of wild flowers in blossom in each week of the summer. Dr. Cooke has prepared a set of 16 large original coloured drawings of the groups of flowerless plants native to the Forest, with which to fill the screens in the "Oak Room." And Mr. W. Cole has prepared and arranged a series of the larvæ of Forest Lepidoptera, mounted on their appropriate food plants, these last being natural specimens.

Mr. Chalkley Gould has completed the arrangement of the series of specimens from the Romano-British village at Chigwell, and the Council may be permitted to say that in a few small local museums can be seen a collection of the kind better displayed and illustrated by plans and descriptive tablets.

THE PROPOSED PHOTOGRAPHIC SURVEY OF ESSEX.—Considerable interest has been aroused by Mr. Briscoe's proposals published in the April part of the *ESSEX NATURALIST*. The details for the practical realization of the scheme are now almost completed. It is hoped that a county meeting for the purpose of bringing this matter before the Essex people may be organised in the summer. The members will be further advised of this in due course.

PRESIDENCY.—The Council has great pleasure in recommending the members to re-elect Mr. F. W. Rudler, I.S.O., F.G.S., etc., as President for the coming Club year.

WOODEN WATER-PIPES AT CLERKENWELL, LONDON.

By F. W. READER.

With Plate XI.

OWING to the great interest that the Essex Field Club has shown in the matter of wooden water-pipes, the accompanying illustrations may perhaps be acceptable, as adding to the large amount of information on the subject already collected in the pages of the *ESSEX NATURALIST*, by Mr. T. V. Holmes and others.¹

The original drawings from which these views have been reproduced are in the collection of the Soane Museum, and represent the course of the New River mains in the fields at Clerkenwell about the year 1800.

As topographical records they are extremely interesting, though in this particular they may hardly be thought to come within the province of the Essex Field Club. A few remarks may be admissible.

Both the views are taken from about the same spot, which is on the course of the Fleet River, at this time an open stream as far as Holborn Hill. The locality is that traversed by the King's Cross Road, formerly known as the Bagnigge Wells Road. At the present time the district is dull and squalid, offering apparently little of interest to the casual visitor. The great changes that have taken place in recent years might well lead one to suppose that all traces of its condition a century ago, when it formed a stretch of open meadows intersected by streams, would long since have been obliterated. However, the valley of the Fleet, though considerably filled up, is still to be recognised in the rise of the streets on either side of King's Cross Road, and other landmarks remain, so that with the aid of old engravings and maps many of the features of these drawings may still be clearly traced.

The upper view shows the mains crossing the Fleet in the Spa Fields, and stretching on the left-hand side of the picture to the New River Head by Sadler's Wells. Here at the present time the New River Head remains, and Sadler's Wells Theatre still exists, though there is little to tell of its former glories and triumphs, while the name by which it is still known "Old Sads" seems singularly appropriate in its now dismal and fallen condition.

The street of houses seen in the distance is Exmouth Street, then occupied by well-to-do people. The domed building seen over the houses to the right is Spa Fields Chapel, once famous as Lady Huntingdon's Chapel. This has in quite recent years disappeared, and the church of the Holy Redeemer has been built on its site.

The high wall on the right is that of the County Gaol, afterwards known as the House of Correction or Cold Bath Prison. This has now been

¹ *ESSEX NATURALIST*, Vol. xlii., pp. 60-75 Ib. 117 and 118, and pp. 229-240.



1. WOODEN WATER-MAINS IN COLD BATH FIELDS.

2. WOODEN WATER-MAINS CROSSING THE FLEET NEAR BARNIDGE WELLS.

From Original Drawings in the Essex Museum.

converted into the Parcels Post Office, but some portions of the Prison walls still remain.

The Bagnigge Wells Road, now King's Cross Road, is seen crossing the picture from left to right in the mid-distance, marked by the line of fence. Directly in the foreground is the Fleet Ditch, spanned with an arch to carry the mains formed of four lines of wooden pipes.

The second view is from nearly the same point, about the present Calthorpe Street, not far from Rowton Mansions, the spectator looking towards King's Cross.

Conspicuous in the distance to the right are the Tile Kilns; these remained until comparatively recent times. The trees adjoining are those of the gardens of Bagnigge Wells, at this period a flourishing pleasure garden, and through which wandered the stream of the Fleet.

Between the Tile Kilns and the gardens ran the Bagnigge Wells Road, and immediately in front of the Tile Kilns is the Bun House. The bridge in the foreground appears to be the same as that shown in the former view.

These drawings were made for Sir John Soane, not on account of their topographical interest, but for the special purpose of showing the defective system of the New River mains by the employment of these wooden pipes, the Company having incurred the displeasure of the eminent architect.

The question therefore arises, were these mains uncovered as they are here represented, or are we to consider the drawings in this respect diagrammatic?

It appears, on the face of it, improbable that pipes of this description would simply have lain on the surface, unprotected from the weather and from the attentions of mischievously-inclined people.

With all their shortcomings as regards perspective, these drawings show, on comparison with old engravings, such accuracy of detail that one is disinclined to suppose that they are not wholly realistic.

Britton, describing these fields as he remembered them about the same period, says^a:—

"Spa Fields from the south end of Rosoman Street to Pentonville, and from St. John's Street Road to Bagnigge Wells Road, were really fields devoted to the pasturage of cows and to a forest of elm trees, not standing and adorned with foliage in the summer, but lying on the ground to the southward of the New River Head, being destined to convey water in their hollow trunks to the northern and western parts of London in combination with similar pipes laid under the roadways of the street."

From this it would appear that the pipes were actually exposed, though the writer may have been speaking from his

^a Britton's *Auto-Biography*, 1850, p. 62.

knowledge of their existence rather than intending to convey the impression that they were uncovered.

It becomes necessary to consider whether any advantage would be gained by leaving these pipes open, and on this point the account given by Matthews in *Hydraulia*³ is instructive.

[The author then proceeds to give the extracts embodied in Mr. Holmes' paper *ante* pp. 230-1, to which our readers are referred.—ED.]

Such a state of things as there described makes it extremely probable that the expense of time, labour, water, and inconvenience in having to excavate covered pipes in order to discover a leakage, would far have exceeded the greater liability to decay and damage, when the pipes were exposed.

The ease with which defects could be discovered when they were uncovered is strikingly shown in the second view.

Elm also, of which most of these pipes were made, is the wood best adapted to stand changes of wet and dry conditions. It must be remembered, also, that damage from frost would be far less considerable than with metal pipes. At points such as the bridge, from whence the graceful fountains are issuing (View 2), no covering sufficient to form much protection would seem to be possible.

The formation and renewal of these pipes appears to have been a far less difficult matter than has been supposed by modern engineers. In a footnote in *Hydraulia* we are told that the New River Company had a spacious wharf on the Thames at the bottom of Dorset Street, Salisbury Square, for landing timber and commodious shops for boring pipes, etc.

All things considered it seems probable, therefore, that in the open fields around London these wooden water-mains were actually uncovered as shown in the drawings.

³ *Hydraulia, or Mode of Supplying London with Water.* W. Matthews, 1841, p. 66.

ON THE ORIGIN OF THE TERM "SARSEN STONES."

By T. V. HOLMES, F.G.S., *Vice-President.*

[*Read April 16th, 1904.*]

IN my remarks on the Greywethers of Grays Thurrock (ESSEX NAT. Vol. XIII., pp. 197-202) I expressed an opinion that the derivation of the word *Sarsen* from *Saracen* is the correct one. But as the question is one of folk-lore, and as the derivation of *sarsen* is usually ignored in our dictionaries, I am not surprised to find my view considered somewhat doubtful. We may find the word *sarsen* used many times in dissertations on Stonehenge, Avebury, and other primitive stone monuments, by antiquaries of more or less eminence in their day, without a line on the origin of the term. Dr. J. A. H. Murray, in the greatest of dictionaries, is still far from the letter S. And though the Rev. W. W. Skeat, in his *Concise Etymological Dictionary of the English Language* (Oxford, 1882), gives Sarcenet or Sarsnet, "a thin silk, O. F. Sarcenet, a stuff made by the Saracens," the word *Sarsen* does not appear there.

On searching the volumes of the *Gentleman's Magazine Library* likely to contain any reference to *Sarsen-stones*, I can find but one short passage bearing on the origin of the name, though many pages are devoted to descriptions of ancient stone monuments and speculations about them. In "Archæology Part II.," p. 93, there is an article, dated 1829, on "The present state of Abury, Wilts," by Joseph Hunter, which contains the following remarks:—

"The common people of Abury uniformly call these stones *sazzen-stones*. This orthography more correctly represents the sound than *Sarsen-stones*, which occurs in the 'Ancient Wiltshire,' but whether the term is applied exclusively to these, or is common to blocks of stone like these but in their native beds, I cannot say."

The important point is, of course, the fact that *sazzen* or *sarsen* was the term used by "the common people" of Abury in 1829. Those were days in which the village folk of Salisbury Plain and Marlborough Downs may fairly be presumed to have given simply the traditional name, and not one suggested by anything they had read themselves, or by the speculations of more learned persons. And it is obvious that the author of *Ancient Wiltshire* (Sir Richard Colt Hoare, 1758-1838) and Joseph

Hunter differ simply as to the more exact pronunciation of sarsen, not as to the origin of the word.

I have seen a suggestion that possibly the name sarsen may be derived from Sarsden, a village near Andover. But it seems to me that there is a strong presumption against this view, arising from the fact that Sarsden does not seem ever to have been remarkable as a centre of sarsen stones. On the other hand we may learn from Murray's *Handbook to Wilts, Dorset and Somerset* that there is an extraordinary abundance of them near a rude stone monument called "The Devil's Den," between two and three miles east of Avebury. Then, a little south of Avebury, there were "in Aubrey's time 3 stones called the 'Devil's Quoits.'" They are now known as the "Long Stones." While, as regards Stonehenge, the old legend about the "Friar's Heel" shows us the Devil as the traditional builder of the most celebrated of all the rude stone monuments of Britain. And the remark that stones known in Aubrey's time (1627-1697) as the "Devil's Quoits," were known as the "Long Stones" two centuries later, suggests the probability that stories of the Devil in connection with these ancient megalithic structures may once have been much more numerous than they now are.

The lines quoted from Burns in my remarks on the Grey-wethers at Grays (*ante*, p. 197) illustrate the identification of the Devil with "Auld Mahoun" in the folk-speech of south-western Scotland towards the close of the eighteenth century. It seems now desirable to note what evidence there may be of a traditional horror of pagan or diabolical Saracens, or of their connection with rude stone monuments, south of the Solway. While the battle of Tours (A.D. 732) checked for ever the advance of the Saracens into Gaul, and they were driven thence in 755, yet, as Freeman remarks,¹ more especially of the ninth and tenth centuries:—

"Every port of Spain and Africa sent forth ships, for what, on a small scale is called piracy, and on a greater, conquest. These sea-rovers were probably the scum of the Saracenic people, and they certainly exhibited the Saracenic character in its most odious colours. They were mere plunderers and destroyers."

The late Robert Hunt, F.R.S., writing about the traditions and folk-lore of Cornwall more than thirty years ago, noted the common belief among the peasantry in the sacred character of

¹ *Lectures on the History and Conquests of the Saracens.* James Parker, Oxford and London.

their "Cromlech and Druid Stones."³ Also that while peculiar markings on rocks are in western Cornwall referred either to the giants or the devil, in the eastern part of the county they are almost always attributed to King Arthur. With regard to mining traditions, Mr. Hunt notes the way in which "the Jew and the Saracen and the Phoenician are regarded as terms applied to the same people." Waste heaps in ancient tin mines are termed "atall Sarazin." And in a Cornish-English Vocabulary given in Polwhele's *History of Cornwall* (1808) is Sarsyn, a Saracen. Cornwall probably was largely protected from piratical raids by the extremely rugged nature of its coast.

In the *Journal of the Ethnological Society* (N.S.), Vol. II., there is a paper by Lieut. Oliver, read in 1869, on "The Prehistoric Remains of the Channel Islands." The author laments their wholesale destruction in the half-century ending with the date of his paper. He notes the existence, however, at the northern end of Guernsey, not far from Bourdeaux Harbour, of a magnificent Cromlech, known by the name of "L'Autel du Déhus," or "L'Autel du Grand Sarazin." In the same locality is "Le Tombeau du Grand Sarazin," which was partly destroyed in 1810. And Lieut. Oliver remarks that of a stone circle, which once surrounded the first-named monument, only four or five stones remain.

A most important paper, of much later date, is that by Mr. Arthur J. Evans on "The Rollright Stones and their Folk-Lore," which appears in *Folk-Lore : The Journal of the Folk-Lore Society*, Vol. VI., 1895, pp. 6-51. Mr. Evans remarks that the name Rollright takes us back to the time when Roland the Brave stood forth as the legendary champion of Christendom against the Paynim. He notes the general tendency to apply the names of the legendary heroes of the early struggle between Christendom and Islam to ancient monuments at the cost of earlier associations. Then the influence of locality is such that at Stanton Harcourt "the Devil is given the Quoits that west of Offa's Dyke are Arthur's. Considering that the name of Roland could hardly have been attached to the Rowldrich stones before the 10th or 11th century, there seems at least a possibility that he may have here actually displaced the British hero."

Mr. Evans remarks that there can be little doubt that the

³ *Popular Romances of the West of England, etc.* 2nd Ed., 1871. Hotten.

name of Sarsen or Sarsen stones has become applied to the huge ancient blocks of Stonehenge, Avebury and other primitive stone monuments because "Sarsen" is simply the old English name of Saracen, "a name which had already taken this popular form, as we know from its appearance in the Anglo-Saxon Chronicle, in days before the Conquest." The name, as attached to megalithic piles, he continues, is not confined to England :—

"A Breton dolmen bears to this day the name of the Saracen's Oven (*Four du Sarraſin*). A similar application of the word Saracen to such monuments has in fact a wide currency in France. At Forez there is a *Roche des Sarraſins*. Near Arles the megalithic galleries or "allees couvertes" are known as prisons or *magasins des Sarraſins*."

Mr. Evans gives examples of the connection of Roland with prehistoric monuments in France and elsewhere on the Mediterranean coast. A dolmen in the eastern Pyrenees is known as the *palet de Roland* and a menhir of Corrèze as the *Grave de Roland*. And near Taranto, in southern Italy, is a dolmen locally known as the "Table of the Paladins" (*Tavola dei Paladini*).

It can hardly be expected that the word *sarsen* should be found in the folk-speech of Essex as it is in that of Wiltshire. For the sarsen stones of Essex never form conspicuous and mysterious rude stone monuments as do those of Wiltshire, and the destruction of individual specimens would consequently excite little or no local interest. In Essex, also, there would be much more temptation to break them up into building material than in the very thinly pastoral district of Salisbury Plain and Marlborough Downs. The author of *Murray's Handbook to the Eastern Counties* (2nd ed., 1875) remarks that the Eastern Counties are at present entirely without rude stone monuments. It appears, however, that "a circle of stones, 10ft. high was removed from a field at Gorleston, near Yarmouth, in 1768." But as regards this circle the author of *Murray's Handbook* thinks that it was not improbably of Scandinavian origin, as stone circles were raised in Denmark and Sweden "at a comparatively late period." But apart from the not improbable Scandinavian origin of this circle, we should naturally look for vague traditions of the Saracens not in or towards the east but the west of Britain, just as we should expect them in Brittany and the Channel Islands rather than around Calais and Boulogne. For we must remember that the Saracen corsairs were little known or dreaded in the Eastern Counties, where the

Danes have left the lasting impression marked by the existence and traditional name of the *Deneholes* of Kent, Essex, and Durham.

NOTE.

As connected with the former prevalence of Saracenic traditions in this country the occurrence of the "Saracen's Head" as an inn sign may be worth notice here. Messrs. Larwood and Hotten, in their well-known *History of Sign-Boards*, make the general remark that only a few of what may be called historical signs outlive the century which gave them birth. The long existence of the Saracen's Head is therefore the more noteworthy. They state that it was formerly very common, and note that the Saracen's Head, Snow Hill, London, mentioned in *Nicholas Nickleby*, is alluded to by Stow as "a fair and large inn for receipt of travellers, and hath to sign the Sarrazen's Head." But the name is not one likely to be seen among the inns mentioned in *Murray's Handbook* to any county or district, as it obviously would suggest to the tourist an ancient and primitive inn, rather than a hotel with all the latest appliances. It is therefore difficult to ascertain the extent of its survival at the present day. However, on looking through Bradley's *Highways and Byways in North Wales*, I found mention of a Saracen's Head at Cerrig-y-Druuidion in Denbighshire. My cousin, George Graham, a resident in Carlisle, tells me that there is one in that city, and that he has seen others in the district, though he cannot exactly remember where. And from Miller Christy's *Trade Signs of Essex* we learn that there are Saracen's Heads at Chelmsford, Dunmow, Danbury, Thaxted, and Braintree, and that they were formerly much more common than they are now.

ON THE REMAINS OF A SUPPOSED PILE-DWELLING AT WOODHAM WALTER, ESSEX.

BY MILLER CHRISTY, F.L.S.

THE large expanse of waste land known as Woodham Walter Common is intersected, near its southern extremity, by a small streamlet, which occupies a remarkably-narrow steep-sided valley—certainly one of the narrowest, deepest, and most picturesque valleys in Essex. This stream, after leaving the Common on its eastern side, runs past the village of Woodham Walter, and thence into the Chelmer near Ulting Hall.

About two hundred yards below the point at which the stream leaves the Common, its valley is crossed, at a specially-narrow place, by a massive artificial dam of earth, about fifty yards long and twenty-five feet high. This clearly once held up a mill-pool five or six acres in extent, but is now cut through by the stream. The dam has evidently been broken for a long period; for oaks and other trees at least several hundred years old grow on the dam itself and on ground which once formed the bottom of the pool.

Similar dams are found commonly throughout Essex, wherever the valley of a stream permits of one being constructed with advantage. They held up the waters which, in Mediæval times, supplied the power needed to drive corn-mills, fulling-mills, and the like. Their pools served also as fish-ponds in the days when means of transport were so bad that fresh sea-fish were almost unknown, except upon the coast, and fresh-water fish were of real importance as a form of food-supply. Sometimes a string of such pools exists, one above the other, along a valley, as at Leighs Priory, Woodham Walter Hall, and elsewhere in this county.

About a hundred yards below the large dam above-mentioned is a much smaller dam, not more than about twenty yards long and ten feet high. This is also broken. It is situated just below the point at which a small tributary streamlet joins the main valley, and can never have held up a pool of more than an acre in extent. The bed of the pool is now overgrown with bushes, while an oak of fair size grows actually on the dam itself. One

assumes naturally that this dam, as the smaller of the two, is the earlier.¹

At the present time, the bed of the stream cuts through the middle of what was once the bed of this smaller pool. Some months ago, I happened to notice in one of its banks, at a spot which must have been near the centre of the pool, a remarkable horizontal stratum of very black earth. This black soil proved, on examination, to be formed of burned vegetable matter, and to contain a very large number of small flints, very much cracked and calcined, with a smaller number of sandstone pebbles, now soft and friable through having been exposed to intense heat. I have placed specimens of these stones in the Essex Field Club Museum at West Ham.

The black deposit containing these stones, as it shows in the bank of the stream, is from twelve to fifteen inches thick, and may be traced horizontally for seven or eight feet. Probably it extends further at each end; but, if so, it is concealed by the roots of trees and bushes. Probably, also, it might be traced in the opposite bank of the stream, but a good deal of fallen surface-soil would have to be removed to ascertain this definitely. The black earth and flints rest *directly* on yellowish sandy clay, which clearly once formed the bottom of the valley and is quite undisturbed. Above the black deposit is modern alluvium, to a thickness of eighteen inches or two feet.

The questions arise: What is the age of this deposit? Of what is it the remains?

That it is of considerable age may be inferred, I think, from the thickness of the overlying alluvium; from the absence of any traces of undecayed vegetable tissue; and from its extreme solidity, the flints being so wedged together that it is not easy to insert a hammer-point between them. I assume, indeed, that the deposit belongs, without doubt, to the Pre-historic Period.

To explain how the deposit (whatever its age) came to be in the position in which we find it is more difficult. Many would dismiss it, no doubt, as merely an early hearth-place. It may be so, but I can see no obvious reason why Early Man should have

¹ Mr. Mothersole points out that, as a large amount of earth has clearly been removed from one end of the large dam, the smaller dam may have been made out of part of the material of the larger; in which case, the smaller would be the later. I think, however, that the earth missing from the larger dam was probably washed away when the dam was broken.

required to light a fire in the centre of the bed of an artificial pool, or, even if he did so, why he should burn in it a large quantity of flints and other stones. Moreover, the fact that the undisturbed sandy clay on which the deposit rests shows no sign of the action of fire is strong evidence that the burning did not take place *in situ* ; while the extent of the deposit (even if no greater than is now visible) is also against the idea that it is merely an ancient domestic hearth.

The only suggestion I am able to offer in explanation of the presence of the deposit is that, over the spot where we find it (that is to say, about the centre of the pool), there was once a pile-dwelling which, through some misfortune, was destroyed by fire, and that, as it burned, the flints and other stones which formed the floor fell to the bottom of the pool, together with the ashes and other remains of the dwelling. The spot is just such a one as would be chosen as a dwelling place by Early Man, for it is well concealed, and in former days the surrounding country was even more densely wooded (as the name of the parish implies) than it is now.

The theory I advance, though admittedly in need of further support, is plausible at the least, and may serve till a better is forthcoming. Since I first discovered the deposit, I have visited it in company with Mr. Mothersole, of Chelmsford, who had no better suggestion to make. The only means of putting the theory to the test, and of ascertaining definitely the origin and extent of the deposit is, of course, to excavate its site by means of the spade. If this were done, fragments of pottery or other objects of human handiwork, sufficient to afford evidence as to its date and origin, would probably be brought to light. It seems very desirable that such investigation should be made. Who will undertake it ?

THE UREDINEÆ AND USTILAGINEÆ OF ESSEX: A CONTRIBUTION TO THE FLORA OF THE COUNTY.

By F. J. CHITTENDEN, *Technical Laboratories, Chelmsford.*

SO far as I am aware, the only lists of records for Essex of the occurrence of the interesting rust and smut fungi at present published are those by Dr. M. C. Cooke in the *ESSEX NATURALIST* 1887, pp. 185 et seq., and by Mr. E. D. Marquand in his list of plants collected by the late Mr. E. G. Varenne, M.R.C.S. (E. N., V. 1891, pp. 21-23).

The following list is compiled (1) from the records got together by Mr. A. W. Heaver, of Maldon, as the result of the work of a class held in that town for the study of these fungi, which he has kindly allowed me to use, (2) from specimens collected by Mr. H. Whitehead, of the Essex Field Club Museum, which he has kindly allowed me to examine, and (3) from specimens in my own herbarium collected either by Mr. E. E. Turner, of Coggeshall, or by myself.

The nomenclature of Plowright's *British Uredineae* has been followed in the list; the various forms, æcidia, uredo, and teleutospore forms of the same fungus, when such alternating forms occur, being listed under one name. The following list differs in form from the two cited above, in which the different forms are mostly listed under different names, *e.g.*, the three forms of the corn rust, *Puccinia graminis* are given in Dr. Cooke's list under "*Æcidium berberidis*," "*Uredo linearis*," and "*Puccinia graminis*"; on the other hand, in a few cases more than one fungus is included under one name, *e.g.*, in Mr. Varenne's collection, now in the museum of the Essex Field Club, and which, through the courtesy of Mr. Cole, I have been able to carefully examine, I find specimens of *Phragmidium fragariastris*, *P. tormentillæ* and *Uredo agrimonie* included under the name "*Uredo potentillarum* D.C." These differences in nomenclature have arisen largely through research into the life-histories of the rust fungi, but they make comparison of lists published at various times a somewhat laborious task, and accurate comparison in the absence of specimens very frequently an absolute impossibility. I have therefore inserted the names used by

Messrs. Cooke and Varenne in brackets after the name I have used, or after the initial indicating the form to which they refer in my list, wherever such names are different from those used in the present compilation. In one or two cases in Dr. Cooke's lists I am unable in the absence of specimens to say precisely to what forms the names refer.

The following list contains records of 85 sp. out of about 260 given in Dr. Plowright's monograph ; Dr. Cooke records 9 species not given below, and Mr. Varenne's collection includes 12 species of which no fresh records are available—these with *Puccinia bupleuri* recorded by Mr. Plowright (*Monograph*, p. 154), from Walton-on-the-Naze, make a total of 103 species known from the county. This number will, on further search, doubtless be largely augmented, although, of course, the distribution of these fungi depends on the distribution of the host plants.

An excellent paper by Dr. Cooke on this group of plants is published in the *ESSEX NATURALIST*, Vol. iv., pp. 28-39, containing many useful suggestions on the collecting and study of minute fungi. There is room for very considerable further work with these and other groups of fungi in the county, and I have only to add that it will give me very great pleasure to render any aid in my power in naming specimens, etc., for anyone who will collect them.

Thirty species are recorded below which do not appear in either of the lists quoted above, including two species not mentioned in Dr. Plowright's monograph, viz., *Puccinia acetosæ* Schum., and *Melampsora orchidi-repentis* Plow. These new county records are indicated by an asterisk * ; in the cases where the host plant upon which the parasite is growing is not mentioned in Dr. Plowright's book, a dagger † is placed before the name of the host.

The following abbreviations are used :—

Æ indicates *acidium* form.

U „ *uredospore* „

T „ *teleutospore* „

The initials in brackets after the names of the localities indicate upon whose authority the record is given :—

H. indicates Mr. A. W. Heaven, of Maldon.

T. „ „ E. E. Turner, of Coggeshall.

W. „ „ H. Whitehead, of the Essex Field Club Museum.

C. „ „ Myself.

UREDINEÆ.

Uromyces fabæ Pers. (*Puccinia fabæ*, Link).

U. On *Faba vulgaris*, Maldon (H.); on *Vicia cracca*, Beeleigh (H.); on *Lathyrus pratensis*, Witham (T.).

T. On same hosts and localities and at Loughton on *Lathyrus pratensis* (W.).

***U. limonii** D.C.

Æ., U. and T. On *Statice limonium*, Maldon (H. and T.).

U. polygoni Pers. (*U. aviculare* D.C.).

U. On *Polygonum aviculare*, Runsell Green and Woodham Walter (H.).

T. Same localities and Chelmsford (C.).

U. trifolii Alb. and Schw. (*U. apiculosa* Lev., *U. appendiculata* Lev.).

U. On *Trifolium pratense*, Beeleigh (H.).

T. On *T. pratense*, Broomfield and Chelmsford (C.); on *T. repens*, Chelmsford (C.); on †*T. hybridum*, Chelmsford (C.).

U. geranii D.C.

Æ. (*Æcidium geranii* D.C.) On *Geranium molle*, Coggeshall (T.); on *G. dissectum*, Broomfield (C.).

U. and T. (*Trichobasis geranii* B.). On †*Geranii perenne*, Feering (T.).

U. betæ Pers.

Æ. On *Beta maritima*, Canvey Is. (W.). (Mr. Plowright states that the æcidiospores of this species are rare in a state of nature, Brit. Ured., p. 127).

U. and T. (*Trichobasis betæ* Lev.). On *Beta vulgaris*, Maldon (H.); Coggeshall (T.); Chelmsford (C.); on mangold. Chelmsford and Writtle (C.).

Uromyces poæ Rabh. (*Æcidium ranunculacearum* D.C., *Æ. ficariae* Pers.).

Æ. On *Ranunculus ficaria*, Beeleigh (H.); Theydon Garnon (W.); Boreham and Chelmsford (C.); on *R. bulbosus*, Maldon (H.); Boreham (C.); on *R. repens*, Langford (H.); Roydon (W.).

U. rumicis Schum. (*U. apiculosa*, Lev., *U. rumicum* D.C.).

U. On *Rumex acetosa*, Maldon (H.); Widford (C.); on *R. hydrolapathum*, Coggeshall (T.).

T. On *Rumex acetosa*, Widford (C.).

***U. behenis** D.C.

Æ. On *Silene maritima*, Brightlingsea (Mr. W. Cole).

U. ficariæ Schum.

T. On *Ranunculus ficaria*, Maldon and Beeleigh (H.) ; Higham Park and Chelmsford (C.) ; Theydon Garnon (W.).

U. scilliarum Grev.

T. On *Scilla nutans*, Maldon and Woodham Walter (H.) ; on †*S. campanulata*, East Hanningfield (C.).

***Puccinia galii Pers.**

U. On *Asperula odorata*, Danbury (H.) ; on *Galium verum*, Woodham Walter (H.)

T. On *A. odorata*, Danbury (H.)

P. lapsanae Schultz.

Æ. (*Æcidium compositarum* Mart., *Æ. lapsanae* Schultz). On *Lapsana communis*, Beeleigh (H.) ; Galleywood and Danbury (C.).

U. (*Uredo lapsanae* Rabh.) Beeleigh (H.) ; Galleywood and Braxted (C.).

T. Same localities as uredo form.

***P. calthæ Link.**

Æ., U., and T. On *Caltha palustris*, Witham (T. and C.).

P. variabilis Grev. (Prob. *Æ. taraxaci* Grev.).

Æ., U., and T. On *Taraxacum officinale*, Maldon (H.).

P. pulverulenta Grev.

Æ. On *Epilobium hirsutum*, Maldon (H.) ; Epping, Coggeshall, Great Waltham, Writtle, and High Easter (C.) ; Witham (T.) ; near Broxbourne (W.).

U. Maldon (H.) ; near Broxbourne (W.).

T. (*P. epilobii* D.C.) Coggeshall (T.) ; Maldon (H.) ; Braxted (C.).

P. violæ Schum.

Æ. (*Æcidium violæ* Schum.) On *Viola odorata*, Maldon (H.) ; on *V. canina*, Maldon (H.) ; Chignal, Great Leighs, Epping, and Witham (C.) ; on *V. tricolor*, Maldon (H.).

U. (*Uredo violæ* D.C.). On *V. odorata*, *V. canina*, and *V. tricolor*, Maldon (H.) ; on *V. canina*, Hazeleigh (C.).

T. (*P. violarum* Link). Same hosts and localities as uredo form.

***P. pimpinellæ Strauss.**

Æ. On *Pimpinella saxifraga*, Pleshy (C.) ; on *Anthriscus sylvestris*, Coggeshall (T.) ; on *Heracleum sphondylium*, Rivenhall (T.).

U. and T. On *A. sylvestris*, Feering (T.) ; Sible Hedingham (C.).

P. menthæ Pers.

Æ. On *Mentha viridis*, Maldon (H.) ; Chelmsford (C.) ; on *M. aquatica*, Maldon (H.).

U. (*Uredo labiatarum* Lev.) On *M. viridis*, Maldon (H.) ; Leyton (C.) ; on *M. aquatica*, Maldon (H.) ; Tiptree (T.) ; Epping Forest (W.) ; on †*Calamintha officinalis*, Danbury (H.) ; Kelvedon (T.) ; on *C. clinopodium*, Feering (T.).

T. On *M. viridis*, Maldon (H.) ; Leyton (C.) ; on *M. aquatica*, Maldon (H.) ; Danbury (C.) ; on *C. officinalis*, Danbury (H.) ; Kelvedon (T.) ; on *C. clinopodium*, Feering (T.).

P. primulæ D.C. (see *Æcidium primulæ*, Varenne's list).

U. and T. On *Primula acaulis*, Hazeleigh (C.).

P. vincæ D.C.

U. and T. On *Vinca major*, Bocking (T.) ; on *V. minor*, Maldon (E. A. Fitch, Esq.).

P. graminis Pers.

Æ. (*Æcidium berberidis* Pers.) On *Berberis vulgaris*, Braxted (T.).

U. (*Uredo linearis* Pers.) On *Triticum vulgare*, Maldon (H.) ; Writtle (C.) ; on *T. repens*, Beeleigh (H.).

T. On *T. vulgare*, Maldon (H.) ; Writtle (C.) ; the specimen from Wivenhoe under this name appears to me to be *P. magnusiana*.

P. rubigo-vera D.C.

U. On *Bromus mollis*, Coggeshall, Chelmsford and Widford (C.) ; Purfleet (W.) ; on *Bromus sterilis*, Widford (C.). There is a specimen of this in the Essex F.C. Museum, collected by Dr. Varenne at Kelvedon, which does not appear to be mentioned in the published list, unless it is included under *P. graminis*.

P. poarum Niels.

Æ. (*Æcidium compositarum* var *tussilaginis*). On *Tussilago farfara*, Speaney (H.) ; Walthamstow (C.).

P. caricis Schum.

Æ. (*Æcidium urticae* D.C.). On *Urtica dioica*, Beeleigh (H.) ; Boreham and Springfield (C.) ; nr. Broxbourne (W.).

U. (*Trichobasis caricina* Berk.).

- T. On *Carex paludosa*, Beeleigh (H.); Springfield and Chelmsford (C.).
- ***P. obscura** Schröt.
U. and T. On *Luzula campestris*, South Weald (T. and C.); Danbury, Widford, and Epping (C.).
- P. phragmitis** Schum.
Æ. (*Æcidium rubellum* Pers.). On *Rumex obtusifolius*, Beeleigh (H.); Little Braxted (T.); on *Rumex* sp., Canvey Is. (W.).
U. and T. On *Phragmites communis*, Beeleigh (H.).
T. (*P. graminis* β *arundinis*). There is a specimen of this in Mr. Varenne's collection not mentioned in the list.
- [**P. magnusiana** Korn. There are three specimens in Mr. Varenne's collection which appear to belong here; two collected at Kelvedon and listed under *P. arundinacea*, and one at Wivenhoe under *P. graminis*.]
- ***P. perplexans** Plow.
Æ. On *Ranunculus acris*, Writtle (C.).
- ***P. persistens** Plow.
Æ. On *Thalictrum flavum*, Little Braxted (T.).
- P. suaveolens** Pers. -
Spermogonia. On *Carduus arvensis*, Maldon (H.); Witham, Feering, Broomfield, and Coggeshall (C.).
U. (*Trichobasis suaveolens* Lev., *Uredo suaveolens* Pers.) On *Carduus arvensis*, Harlow and Romford (W.); Maldon (H.); South Weald, Coggeshall, and Broomfield (C.); on *Centaurea cyanus*, Maldon (H.).
T. (*P. obtegens* Tul.). Same hosts and localities as the uredoform.
- ***P. bullata** Pers.
U. and T. On *Conium maculatum*, Battlesbridge (C.).
- P. hieracii** Schum. (*P. compositarum* Sch.)
U. On *Carduus lanceolatus*, Beeleigh (H.); on †*Chrysanthemum* Chelmsford, Romford, and Sturmer (C.).
U. and T. In *Hieracium murorum*, Woodham Walter (H.); on *Crepis virens*, Maldon (H.); on *Scabiosa succisa*, Widford (C.); on *Leontodon autumnalis* and *L. hispidus*, Widford (C.).
- P. centaureæ** Mart.
U. and T. On *Centaurea nigra*, Maldon (H.); Loughton (W.).

***P. taraxaci** *Plow.*

U. and T. On *Taraxacum officinale*, Maldon (H.) ; Coggeshall (T.) ; Broomfield (C.).

P. polygoni *Pers.* (*P. amphibii* Fckl., *P. polygonorum*, Link.).

U. (*Uredo polygonorum*, D.C.). On *Polygonum amphibium*, Beeleigh (H.) ; on *P. convolvulus*, Woodham Walter (H.) ; Chelmsford and Broomfield (C.) ; on *P. lapathi folium*, Braxted, Broomfield and Springfield (C.) ; on †*P. sieboldii*, Witham (T.) ; on †*P. persicaria*, Maldon (H.).

T. Same localities and hosts.

P. tanacetii *D.C.* (*P. discoidearum*, Link.).

U. and T. On *Tanacetum vulgare*, Maldon (H.) ; on *Artemisia vulgaris*, Maldon (H.).

P. pruni *Pers.* (*P. prunorum*, Link.).

U. and T. On *Prunus domestica*, Maldon (H.) ; Witham (T.).

***P. anthoxanthi**, *Fckl.*

U. On *Anthoxanthum odoratum*, Widford (C.).

P. lychnidearum, *Link.*

U. and T. On *Lychnis diurna*, Maldon (H.) ; Kelvedon (T.) ; Hazeleigh and Linguard Common (C.).

***Puccinia acetosæ** *Schum.*—I am not aware that this is anywhere, except in a MS. list in my possession, referred to as British. I therefore append a description :—

Sori scattered, on the leaves small, irregularly rounded, on the stems and petioles oblong, not long covered by the epidermis. Uredospores globose, elliptic or pyriform, $24-30 \times 20-25$ u., brown, echinulate. Teleutospores oblong or subclavate, constricted in the middle, apex rounded, $30-45 \times 20-25$ μ ., subverrucose, chestnut-brown, pedicels hyaline, long, slender, deciduous.

On *Rumex acetosa* and *R. acetosella*.

Occurring in Germany, Switzerland, and Italy.

[See Korn in *Hedwigia* 1876, p. 184 ; Winter *Die Pilze*, p. 187 ; Schroet. *Pilz. Schles.* p. 339 ; Sacc. *Sylloge*, Vol. vii., p. 638 ; Syn. *Uredo acetosae*, Schum. (*Saell.* II. p. 231) ; *Puccinia rumicis* Lasch. (in *Rabenh. Fungi Europ.* p. 496).]

Mr. Heaven found a rust fungus on *R. acetosella* at Maldon, and Dr. Plowright, to whom I am indebted for references to the original descriptions of the fungus which I have consulted, referred it to this species.

P. tragopogi *Pers.*

Æ. (*Æcidium tragopogonis* *Pers.*). On *Tragopogon pratensis*, Maldon (H.) ; Boreham (C.) ; nr. Broxbourne (W.).

- T. (*P. sparsa*, Cooke), Maldon (H.).
- ***P. betonicæ** *Alb. and Schw.*
T. On *Stachys betonica*, Totham (T. and C.); Theydon Garnon (W.).
- P. fusca** *Rehl.* (*P. anemones* Pers.).
T. On *Anemone nemorosa*, Maldon (H.); Woodham Walter and Wickham Bishops (C.).
- ***P. bunii** *D.C.*
T. On *Bunium flexuosum*, Totham (T. and C.).
- ***P. adoxæ** *D.C.*
T. On *Adoxa moschatellina*, Maldon (H.); Higham Park (C.); Rivenhall (Mr. W. Pratchett); Theydon Garnon (W.).
- P. senecionis** *Lib.* (*P. glomerata* Grev.).
T. On *Senecio aquaticus*, Springfield (C.); Feering (T.).
- P. arenariæ** *Schum.* (*P. lychnidearum* Link. *P. mæhringia* Fckl.).
T. On *Dianthus barbatus*, Finchingfield (C.); on *Arenaria trinervia*, Coggeshall (T.).
- P. valantiæ** *Pers.* (*P. acuminata* Fckl.).
T. On *Galium saxatile*, Galleywood (C.).
- P. malvacearum** *Mcnt.*
T. On *Malva sylvestris*, Maldon (H.); Widford (C.); Harlow and Purfleet (W.); on *M. rotundifolia*, Southend, Boreham and Danbury (C.); on *Althæa rosea*, Leyton and Chelmsford (C.).
- ***P. glechomatis** *D.C.*
T. On *Glechoma hederacea*, Woodham Walter (H.); Markshall (T.).
- ***P. asteris** *Duby.*
T. On *Aster tripolium*, Maldon (H.).
- P. cardui** *Plow.* (*P. syngenesiarum*, Link.).
T. On *Carduus lanceolatus*, Purfleet and Epping Forest (W.).
- Triphragmidium ulmariæ** *Schum.*
U. On *Spiræa ulmaria*, Beeleigh and Danbury (H.); Boreham (C.).
T. Danbury (H.).
- Phragmidium fragariastrum** *D.C.*
Æ. On *Potentilla fragariastrum*, Maldon (H.); Great Leighs and Witham (C.).

- U. (*Uredo potentillarum* D.C.), Maldon (H.).
 T. Maldon (H.).
- P. tormentillæ** Fckl.
 U. (*Uredo potentillarum* D.C.) On *Potentilla tormentilla*, Marks-hall (T).
- *P. violaceum** Schultz.
 U. and T. On *Rubus fruticosus*, Danbury (C.).
- P. rubi** Pers (*P. bulbosum* Fries, *Uredo ruborum* D.C.).
 Æ. On *Rubus fruticosus*, Maldon (H.); Epping and Purfleet (W.).
 U. and T. Maldon (H.).
- P. subcorticatum** Schrank (*P. mucronatum* Link. *Uredo rosarum* Link).
 Æ. On *Rosa canina*, Maldon (H.); Brentwood, Chelmsford, Broomfield, Feering, Halstead (C.); Debden Green, Epping (W.).
 U. and T. Danbury (C.).
- Gymnosporangium clavariæforme** Jacq.
 Æ. (*Ræstelia lacerata* Fckl). On *Cratægus oxyacantha*, Maldon (H.).
- Melampsora helioscopiæ** Pers. (*Uredo euphorbiæ*, Reb.).
 U. On *Euphorbia exigua*, Maldon (H.); on *E. peplus*, Maldon (H.); on *E. helioscopia*, Chelmsford and Coggeshall (C.).
 T. On *E. helioscopia*, Chelmsford and Coggeshall (C.).
- *M. lini** Pers.
 U. On *Linum catharticum*, Earl's Colne (C.).
- M. farinosa** Pers. (*M. salicina* Lev. *Uredo caprearum* D.C.).
 U. On *Salix capraea*, Maldon (H.); Coggeshall and Broomfield (C.).
- M. tremulæ** Tul.
 U. and T. On *Populus tremulæ*, Maldon (H.).
- *M. æcidioides** D.C.
 U. On *Populus alba* Maldon (H.).
- *M. betulina** Pers.
 U. On *Betula alba*, Wake Arms, Epping (W.).
- *M. cerastii** Pers.
 U. and T. On *Cerastium arvense*, Feering and Coggeshall (T.).
- *M. orchidi-repentis** Plowr. Mr. Turner found a *Melampsora*

on *Salix repens* at Tiptree Heath, which is in all probability this species. The species of *Melampsora* have for their æcidioform the species of *Cæoma*, and it has been proved by culture experiments that the species occurring on *Salix repens* is connected with *Cæoma orchidis* Alb. and Schw. (q.v.).

It is described and records of the culture experiments are given by Dr. Plowright in *Gard. Chron.* 8, 1890, p. 41; *Journ. Roy. Hort. Soc.* 12, 1890, p. cix.; and *Zeitsch. f. Pflanzenkrankh.* 1, 1891, p. 131. A full account of the relationship of these two genera is given by Klebahn in *Die wirtswechselnden Rostpilze*, 1904, pp. 396-426.

Coleosporium senecionis Pers.

Æ. On *Pinus sylvestris*, Maldon (H.).

U. (*Puccinia glomerata* Cooke). On *Senecio vulgaris*, Woodham Walter (H.); Chelmsford (C.); on *S. sylvaticus*, Danbury (C.); on *S. viscosus*, Woodham Walter (H.).

C. sonchi Pers. (*C. tussilaginis* Lev., *C. petasitis* Lev., *C. sonchi-arvensis* Lev.).

U. On *Tussilago farfara*, Langford (H.); Writtle and Feering (C.); Rainham (W.); on *Sonchus oleraceus*, Beeleigh (H.); Roxwell (C.).

C. campanulæ Pers.

U. On *Campanula rotundifolia*, Runsell Green (H.); on †*C. rapunculoides*, Chelmsford (C.).

C. euphrasiæ Schum. (*C. rhinanthacearum* Lev.).

U. On *Barisia odontites*, Maldon (H.); on *Melampyrum arvense*, Maldon (H.); on *Euphrasia officinalis*, Tiptree and Danbury (C.).

Uredo agrimoniz D.C. (*U. potentillarum*, D.C.).

On *Agrimonia eupatoria*, Coggeshall (T.), Maldon (H.).

Cæoma mercurialis Pers. (*Uredo confluens*, D.C.).

On *Mercurialis perennis*, Coggeshall (T.); Maldon (H.); Theydon Garnon (W.).

***C. orchidis Alb. and Schw.**

On *Orchis maculata*, Galleywood (C.).

***Æcidium leucospermum D.C.**

On *Anemone nemorosa*, Wickham Bishops (T. and C.).

***Æ. incarcerationum B. and Br.**

On *Sagittaria sagittifolia*, Beeleigh (H.).

EUSTILAGINE.

Ustilago longissima Sow.

On *Glyceria aquatica*, Manningtree (C.).

U. hypodytes Schlecht.

On *Triticum repens*, Burnham-on-Crouch (C.).

U. segetum Bull. (*U. carbo* Tul.).

On *Avena sativa*, Sutton and Writtle (C.); on *Arrhenatherum avenaceum*, Chelmsford (C.); Canvey Is. (W.).

***U. bromivora** Tul.

On *Bromus mollis*, Chelmsford (C.); Hazeleigh (T.).

***U. maydis** D.C.

On *Zea mays*, Romford (C. B. Russell, Esq.).

U. violacea Pers. (*U. antherarum* Fr.).

On *Cerastium triviale*, Chelmsford (C.).

U. tragopogi Pers. (*U. receptaculorum* Fr.).

On *Tragopogon pratensis*, Chelmsford (C.).

***Sphacelotheca hydropiperis** Delty.

On *Polygonum hydropiper*, Markshall (T. and C.); Mill Green (C.).

***Urocystis violæ** Sow.

On *Viola hirta* and *V. odorata*, Chelmsford (C.).

SPECIES RECORDED BY DR. COOKE, NOT MENTIONED ABOVE.

Puccinia coronata Corda (syn. *Æcidium crassum*, Pers.).

P. oblongata Link. (syn. *Uredo oblongata* Grev.)

P. hydrocotyles Link (including *Uredo hydrocotyles*, M.)

Ræstelia cancellata Rev.

Melampsora populina Lev. (including *Uredo populina* Muntz).

M. circææ Sch. (syn. *Puccinia circææ* Pers. and *Uredo circææ* Schum.)

Uredo symphyti D.C.

Tilletia striæformis Westw. (syn. *Ustilago salveii* B. and Br.)

Urocystis anemones Pers. (syn. *U. pompholygodes* Lev.)

SPECIES FOUND BY MR. VARENNE, BUT NOT MENTIONED ABOVE.

Puccinia coronata Corda (with *Æcidium crassum* Pers.)

P. magnusiana Korn. (see above)

P. oblongata Link (syn. *Trichobasis oblongata* B.)

Phragmidium rubi-idaie Pers. (syn. *P. gracile* Berk.)

Gymnosporangium sabinæ Dicks (syn. *Ræstelia cancellata* Reb.)

Melampsora epitea Schum. (syn. *Lecythea epitea* Lev.).

M. mixta Schlecht (syn. *L. mixta* Lev.)

M. vitellinæ D.C. (syn. *L. saliceti* Lev.)

M. populina Lev.

M. hypericorum D.C. (syn. *Uredo hypericorum* D.C.)

Ustilago utriculosa Nees.

Tilletia tritici Bjerh. (*T. caries* Tul.)

NOTES—ORIGINAL AND SELECTED.

ZOOLOGY.

MAMMALIA.

Occurrence of De Winton's Mouse in Essex.—On April 23rd Dr. Laver wrote :—" Enclosed is the skin of a specimen of De Winton's mouse. It was given to me on April 2nd, having been caught a day or two before by Mr. Henry Tawell in his store-room at Wakes Colne, Essex. He informs me that he has taken lately four other specimens of the same mouse. He sent it to me marked 'specimen of mouse, new kind'—a very creditable bit of observation, he never having read anything about these mice. It is the first specimen that I have seen since De Winton wrote his paper. I only just got it in time; a few days or even a few hours more and it would have been impossible to save the specimen. You will see that I have preserved it in the position desired by the British Museum authorities."

A short time after Dr. Laver's letter, I received anonymously a specimen in the flesh, which I subsequently found had been sent from Wakes Colne at the suggestion of Mr. T. E. Tawell, a member of the Club. It is now in Mr. Burton's hands for preservation.

This mouse (*Mus sylvaticus wintoni*, Barr-Ham.) was first brought forward as a British animal by Mr. W. E. De Winton in the *Zoologist* for December, 1894,¹ under the name of *Mus flavicollis*, believing it to be the mouse thus named by Prof. Melchior, of Copenhagen, in his work on Danish and Norwegian Mammals. This was afterwards found to be a mistaken identification, and Mr. Barrett-Hamilton in his paper "On Geographical and

¹ *Zoologist* (N.S.), Vol. xviii., pp. 442-45.

Individual Variation in *Mus sylvaticus* and its allies''² considered the form entitled to rank as a sub-species, and gave it the name it now bears, in honour of its discoverer. It is a large wood-mouse, about $4\frac{1}{2}$ inches from snout to base of tail. Mr. De Winton thus compares it with *Mus sylvaticus* :—

"The general colour of the upper parts is brighter, especially along the sides and legs, and the under parts of almost pure white, excepting the gorget or breast-plate of clear yellowish brown ; this band is about 8 mm. broad, passing across the chest, immediately in front of the fore legs, with a cross or longitudinal stripe in the centre extending forward about 5mm. and back along the sternum about 10 mm., where it is entirely lost, unlike the slight dash of colour so frequently found on the chest of *Mus sylvaticus*, and which varies from the smallest spot on the breast to a decided yellow-brown tinge extending over the whole belly. The richer colouring of the upper parts in *Mus flavicollis* and the pureness of the white on the underside, with the very distinct line of demarcation, give this mouse a peculiarly striking appearance ; it is almost as beautiful as a squirrel. Its large ears, and wide-open prominent eyes, its long tail and hind feet are fully as much developed in proportion to its size as in *Mus sylvaticus*, consequently the measurements are greater."

Mr. De Winton mentions that, among other structural peculiarities, the tail has 30 vertebræ, whereas in *M. sylvaticus* there are only 27.

The original specimens were found around Graftonbury in Herefordshire, but it has since been noticed in several parts of S.E., E., and N.E. England. It is recorded for Bury St. Edmunds, Suffolk, by the Rev. Julian Tuck and Lieut.-Col. E. A. Butler. On the Continent it occurs in Central and Eastern Germany and Hungary. We hope that our zoological members will keep a bright look-out for this handsome animal, and send notes to the E.N. One of the keepers in Epping Forest spoke to my brother some time ago about a mysterious large mouse which had been seen when rabbiting.—W. COLE, Buckhurst Hill.

Old Record of Mammoth at Walton-on-Naze.—Mr. T. V. Holmes has kindly copied the following from the *Annual Register* under date November 30th, 1803 (p. 461) :—

* By the falling down of a piece of the cliff, on Walton shore, near Harwich, the skeleton of an enormous animal was discovered, measuring nearly 30 feet in length. Some of the bones were nearly as large as a man's body, and six or seven feet long ; the cavities which contained the marrow were large enough to admit the introduction of a man's arm ; the bones, on being handled, broke to pieces.

² *Proc. Zool. Soc.* (1900), pp. 387-428, pl. xxv.

One of the molar teeth was carried to Colchester by Mr. J. Jackson, who took it from the spot, in whose possession it now is; it weighs seven pounds is of a square form, and the grinding surface is studded with several zig-zag rows of laminae, which seem to denote that it belonged to a carnivorous animal. There were more teeth, which were unfortunately broken, one of which weighed twelve pounds. It is probable, that the tusks will be found by searching further into the cliffs, or amongst the earth which has fallen down. The above skeleton is supposed to belong to an animal of the same species as that called the mammoth, remains of which have been found in North America, Great Tartary, etc."

Food of the Otter.—There is an interesting Essex item in an article entitled "In Defence of the Otter," in the *Spectator* of April 16th, 1904. The writer, while admitting that otters are decidedly mischievous on small preserved artificial pools, does not think they do any appreciable harm in a river the size of the lower Thames. Eels and chub appear to be their favourite food. Among many remarks on the habits of otters, the following may be noted :—

"On a fine lake in Essex, where a pair of otters live all the year round, they seem to confine their fishing enterprises to bream and fresh-water mussels, though probably eels are also largely eaten. They have regular dining places, where they come ashore, and on these flat portions of the bank, generally in a plantation which is kept quiet, as it is full of pheasants, the backbones, skulls and scales of the big bream lie, as well as heaps of mussel-shells, cracked by the otters' teeth."

Porpoises in the Blackwater.—A shoal of porpoises was driven ashore on Saturday morning, July 30, 1904, at West Mersea, and local sportsman and others had quite an exciting time chasing them. About half-a-dozen of the porpoises were killed, but the rest got away to sea.

BIRDS.

Peregrine Falcon at Pitsea, Essex.—The following are the particulars of this bird, which was shown at the meeting of the Club on February 13th, 1904 :—"On Saturday evening, January 23rd, I came into my study from the parish, and was surprised to find a large female Peregrine Falcon, evidently just shot, being still warm, lying on the table. On enquiry I ascertained that it had been shot by Mr. H. Brown, of Chalvedon Hall, Pitsea. He was walking, with his gun, in one of their fields as it was growing dusk, when a bird flew out of some trees at a little distance from him; in the uncertain light and from its noisy manner of flying forth, he took it for a wood pigeon and

shot it. The falcon was a very fine specimen ; it weighed 2lbs. 8½ozs., length 18½ inches, from tip to tip of wings 42 inches ; the tarsus or metatarsus 2½, the longest toe from base to tip of claw 3 inches.—(Rev.) A. BERTRAM HUTTON, *The Rectory, Pitsea, April 8th, 1904.*

Protective Colouring among Birds.—At the meeting of the Club on February 13th last, the Rev. A. Bertram Hutton, Rector of Pitsea, Essex, brought up some photographs and lantern-slides showing how the young Oyster-Catcher (*Hamptus ostralegus*), the eggs of the same bird, and those of the Ringed Plover (*Ægialitis hiaticula*) and the Lesser Tern (*Sterna minuta*), are protectively coloured. The photograph of the young Oyster-Catcher was perhaps the most striking, and was one of those shown as a lantern slide. Mr. Hutton said : “ It was taken on June 3rd, 1903, at the bird colony near Ravenglass, off the coast of Cumberland. My wife and I had visited the place for the purpose of bird photography, and as we were walking over a stretch of sand, in which coarse grass, such as is usually found on sand-hills, was growing, my wife espied this young Oyster-Catcher shamming death. So well did he do it, that she really thought he was dead ; however, a little prod sent him running for dear life, with the photographer carrying the camera after him. He soon subsided, however, and again ‘played possum,’ lying, as still as death, with closed eyes. I took a negative of him in this position, and then said to myself, ‘Yes, you match your environment marvellously now, but what if I turn you over and show your little white breast and body ? ’ So I gently turned him over and there he lay, still like death, with his little feet waving in the air quite limply, the sun pouring down on him sufficiently strongly to induce him to jump up and run to escape the heat, one would have thought, but no, the other instinct was the stronger, and I secured my second negative.”

Notes on Essex Shore-Birds.—Mr. C. J. Cornish, in the course of a very interesting article on “The Results of Wild Bird Protection” in *The Cornhill Magazine* for March, 1901, makes some valuable remarks on our Essex shore-birds, which will be welcomed by our ornithological readers :—

“ Though the Essex coast is so inaccessible and remote, the steady ‘egging’ for market threatened many kinds of birds with extermination. It had been as

rich in shore fowl and wild fowl as it was in decoys. Now, there are only two decoys working in Essex. Gulleries (several), colonies of terns, and ringed plovers, and in the marshes redshanks, oyster-catchers, and snipe, and in the sandhills the harmless and beautiful shell-duck, were once as common in Essex as they are now in the preserved 'dunes' and 'polders' in Holland opposite, where I have seen them swarming on thousands of acres as thickly as of old. Parts of Essex were indeed so full once of breeding wild fowl and shore birds, that they might have taken a local name from them, as did the island of 'Eyre-land' by the Texel opposite.¹ The young shore fowl used to be fattened. Fuller says that there was an island of 200 acres near Harwich called 'Pewit Island' (pewits were black-headed gulls), of which they 'were in effect the sole inhabitants. On St. George's Day precisely they pitch on the island, seldom laying more than six or fewer than four eggs. Great is their love to their young ones, for though against foul weather they make to the mainland (a sure prognostication of tempests), yet they always weather it out on the island when hatching their young ones, seldom sleeping when sitting on their eggs (afraid, it seems, of spring tides), which signifieth nothing as to securing their eggs from inundation, but is an argument of their great affection.' Fuller is always good reading when he deals with what he calls the 'natural commodities' of a county, and he adds to this sympathetic and quite correct description of the gulls that the young ones when taken to be eaten consist only of bones, feathers, and lean flesh 'which hath a raw gust of the sea,' but that they are fattened by the poulterers on curds and gravel, which are meant both as food and physic, and that their flesh thus 'recruited' is most delicious.

"The era of young sea gull pie will probably not return, but the Essex Bird Society's report says that owing to an inundation which has made Pewit Island a swamp, this ancient gullery seems likely to be re-established. In spite of the great inundations of 1898, which broke the Essex sea-walls, and the high tides which flooded the salt marshes, the following reports show that birds have increased there in the short time since the foreshore was protected. Bearing in mind that total destruction overtook many breeding-grounds which looked most promising (I have myself seen three miles of shore dotted with eggs all along high-water mark on the edge of a protected salt marsh in Norfolk), the report is very promising.

"The concrete results are that the ringed plover have increased generally. The terns have been saved from extermination, and will soon, it is hoped, recover their numbers as fast as they have at Wells. Until lately they were raided every year by professional egg-robbers, who took the eggs and *stuffed* the poor little terns, shooting the old ones later on when the 'season' opened to stuff with them.

"Mr. George Hope, of Havering Grange, informs me that at Havergate Island he heard that arctic, common, and lesser terns all did better than usual this year, and that he saw more himself, and that he has seen a black tern (a species which once bred in England, but now does not).

"Outside the sea-walls are half dry saltings along scores of miles of the Essex shore. The birds seem to have learnt that they are now safe there, and nest in numbers where they did not before. It was there, unfortunately, that last year's high tides overtook them. Gulls are increasing fast, mainly the small black-

¹ Cæsar notes that in his time the savages on the islands near the mouths of the Rhine lived on fish and birds' eggs.

headed kind. But several pairs of the lesser black-backed gull have appeared, and stayed all the summer through on certain marshes. It is believed that these birds have returned and bred there.

"The oyster-eaters have been seen nesting in a fresh locality, and the shell ducks, the largest of all shore fowl, are reported to have bred. Shooting shore fowl, which is an ancient Essex industry, is not allowed till August 15, which saves the birds being murdered by Bank Holiday trippers. Suffolk should come into line on this point, for it is absurd to be protecting birds on August 1 at Harwich, while they are allowed to be shot across the river at Felixstowe."

FISHES.

A Salmon in the Blackwater.—A salmon weighing 4½ pounds has been found in an injured condition in the river Blackwater, at Kelvedon, Essex, but how it reached so far inland is a mystery. That portion of the river where the salmon was discovered is leased by the Gresham Angling Society, and the theory most favoured by the members is that it came up the Blackwater on the last big flood. Kelvedon is many miles from the estuary of the Blackwater below Maldon, and the salmon would encounter several weirs and mills in its ascent to the higher reaches. Years ago occasional salmon were caught in the nets in the tidal portion of the Blackwater, but a specimen of this fish has never been seen before in the river at Kelvedon. *The Times*, April 12th, 1904.

Why Fish is Scarce.—The increasing scarcity of fish in the North Sea is attributed by Mr. H. Donnison, the Eastern Sea Fisheries Inspector, to the sufferance of the natural enemies of fish. In the Wash, which is a great fish nursery, there are, he says, in his half-yearly report, hundreds of seals, tens, if not hundreds, of thousands of gulls, beside comorants, all living on fish, of which a cormorant alone can eat seven pounds daily. As these destroyers prey chiefly on small fish, enormous havoc is caused among fish which otherwise would find their way into the fishermen's nets. Of shell-fish, for example, Mr. Donnison states that the gulls consume far more in an infant state than are taken by fishermen in an adult state.

MOLLUSCA.

Limax cinereo-niger Wolf., in **Essex.**—This slug, which has not been recorded previously for the Eastern Counties, is common in Epping Forest near High Beach. It has also been found near Staples Hill, Loughton, and in "Cook's Folly," Walthamstow.—T. PETCH, *Leytonstone*, June, 1904.

Oysters and the Typhoid Bacillus.—The *Times* of January 11th, 1904, had a leading article on the conclusions set forth by the Royal Commission on Sewage-Disposal with reference to the precautions which can be taken for the preservation of oysters from the *Bacillus* of Typhoid. An excuse for the reluctance of the Commissioners to recommend stringent measures for the prevention of the outfall of untreated sewage into tidal estuaries lies in an unexpected bacteriological difficulty. The chief risk from sewage contamination arises from the possible presence of the typhoid bacillus. This bacillus is fortunately rare, but the *Bacillus coli-communis*, which is invariably found in the human alimentary canal, and has hitherto been regarded as evidence of sewage contamination, is now found to be generally present in the oyster "even when this creature is of the most unspotted character." In short, the *Bacillus coli-communis* may be as natural to the oyster as to man, and therefore its presence cannot be regarded as evidence that the oyster has lived in sewage-contaminated water. The Commissioners, however, hold out hopes of being able to say that the colon bacilli in an oyster should not exceed a certain number, excessive quantities of them only being regarded as indicating sewage contamination.—T.V.H.

INSECTS.

Deilephila Livornica near Romford.—Our member, Mr. G. P. Hope, of Havering Grange, near Romford, writes that on July 17th he found feeding on *Antirrhinum* in his garden a larva which he and several entomologists to whom he has shown it consider to be *Deilephila livornica* (= *lineata*)—the "Striped Hawk-Moth." The larva of this moth is very variable, and Mr. Hope's specimen differs from the figures in "Buckler" and "Westwood," but Mr. Fenn and others have little doubt as to the species. *D. livornica* is very rare in Essex (as indeed everywhere in Britain), but has occurred near Colchester, Walton-on-Naze, Upton Park, Walthamstow, etc. The natural history journals record the capture of several specimens this season, and Mr. Hope mentions one that was sent to a friend from South Devon early in May. All these specimens are doubtless immigrants from the continent, and Mr. Hope's caterpillar would be the progeny of one of these spring visitants. The larva has

fed up very rapidly, and has now formed a slight cocoon in the earth, but Mr. Hope fears that it has been "stung" by ichneumons. In all probability we shall hear of more captures of this rare sphinx this summer.—ED.

ECHINODERMATA.

Henricia sanguinolenta in the Colne River.—On May 29th, Dr. Henry Laver wrote :—"On Thursday, the 26th, our Fishery Board inspected the Colne, dredging in various parts of the river. Towards the mouth of the river the star-fish I send came up in a dredge, and I saved it for you, as it was something fresh to me, and neither of the dredgermen on board recognised it. . . . Fortunately for our Fishery there are very few star-fishes in the Colne, and in all we did not draw up more than five or six during the day. There was one having a small oyster in his embrace; I don't think he had killed it, but it would have been only a question of a little time.

The star-fish sent by Dr. Laver was *Henricia sanguinolenta* O. F. Müll=*Cribella oculata* Forbes. As far as I know, this is an addition to our, at present, slender list of Essex Echinoderms. It is very different in appearance from the common star-fish (*Asterias rubens*); when taken from the water it is stiff, and does not drop flaccidly when lifted up as the *Asterias* does. In Mr. F. Jeffrey Bell's *Catalogue of British Echinoderms*, it is given a very wide area, horizontally and vertically, both sides of N. Atlantic, Arctic Ocean, and North Sea littoral to 1,350 fathoms. Bell records many Scottish localities and says that the species occurs at Plymouth, Weymouth, and Worthing, but gives no intermediate eastern localities. Dr. Laver has kindly presented the specimen to our Museum.—W. COLE, Buckhurst Hill.

BOTANY.

Lathræa squarmaria, L. in Essex.—I had a piece of this interesting parasitic plant, the "Toothwort," sent me to-day from what appears to be the locality indicated in Gibson's *Flora of Essex*—"in a meadow near Halstead, but very rare," where it was recorded by Mr. Thomas Bentall (date ?). It is interesting to know that this plant, so rare in Essex—I know of only one other locality for it in the county, a locality kindly pointed out to me by Mr. E. E. Turner, of Coggeshall, in the same district—

has maintained itself in the same spot for at least forty-three years.—FRED. J. CHITTENDEN, *Technical Laboratories, Chelmsford, April 18th, 1904,*

Surviving London Wild Flowers.—In the *Times*, of October 17th, 1903, Mr. C. J. Cornish has the following interesting letter :—

“ Though the author of the *Flora Londinensis* would no longer find the rare plants which in his day grew in Lambeth Marsh, the number of wild flowers still found in the London area is much larger than would be readily believed. That this is so is clear from a remarkable collection of the wild flowers remaining in Fulham, a London borough of some 250,000 inhabitants, made by Mr. W. Clarkson Bich, and presented by him to the Field Club of St. Paul's School. The collection, which is only of leaves and flowers, not of the roots of the plants, was made in a twelvemonth, and contains no less than 130 varieties of flowering plants, though the market gardens, for which Fulham was famous, have almost disappeared, and bricks and mortar are rapidly taking their places. It would puzzle most people to guess where these flowers could have found room to grow. Fortunately there is nothing which many flowers like so much as a rubbish heap or a bit of waste ground. As the market gardens or sites of old houses are taken up for building and enclosed, but before operations actually begin, the flowers and plants rise up to take what fancy might describe as their last farewell to London. The sides of reservoirs are also homes for London flowers. But among their best retreats are the banks of the London river, where many of the water plants still survive, and the bank flowers are recruited by seeds washed down from the upper Thames. From the river bank came the poisonous hemlock, dropwort, two kinds of pepperwort, several kinds of cresses, and gipsywort, with nettle-shaped leaves and white flowers. On a reservoir embankment, lately made, were quantities of greater skull-cap, with blue tubular flowers, and a specimen of the great willow herb and purple loosestrife. I have seen plants of the former growing abundantly in the foreyard of an old house, which was set aside to be pulled down near the Hammersmith Road. A balsam called “ touch-me-not,” because the pods when ripe open with a spring when touched, and eject the seeds, is also found there. It is said to have become naturalised on the banks of the Wey. If so, possibly its seeds have passed from the Wey to the Thames, and from the Thames to Fulham. But the wanderings of plants are illustrated in a remarkable fashion by two species in this collection—one called *Galinisoea parviflora*, and the other, a very remarkable plant, *Tetragonia crystallina*, a native of Chile. Its leaves are coated with what look like spangles of ice crystal, from which its name is derived. Both plants were found by Mr. Birch growing on a rubbish heap near the Crab Tree, famed in accounts of the Oxford and Cambridge boat race. A specimen of the *Aster tripolium*, or sea starwort, was found growing by the river, a plant usually found on salt marshes, and plentiful at Canvey Island, at the river's mouth. How did it get to Fulham? The purple-flowered lucerne grows on the reservoir banks in abundance. Even the harebell was found, and cuckoo flower, bristly ox-tongue, self-heal, scarlet pimpernel, crane's bill, mallow, and the London rocket are among other flowers in the list.”

ANTHROPOLOGY.

Supplementary Note on Ancient Water-pipes.¹—As a further piece of negative evidence in support of the comparatively late introduction of wooden water-pipes in England, I submit the following item from Leland's *Itinerary* (c. 1540):—

"Mr. *Gostewik* beyng borne in *Willingtoun* bouthe this Lordship of the Duke of *Northfolk* now lyving, and hath made a sumptuous new Building of Brike and Tymbre à *fundamentis* in it, with a conduct of water derivid in Leade Pipes." (Leland's *Itinerary* 1745, Edn., i., 112.)

—A. MORLEY DAVIES.

Proposed Dam across the Lea Valley.—In the *Times* of September 15th is reprinted a passage from the issue of September 15th, 1803, of a project which recalls Alfred's operations against the Danes. Amongst the preparations, in dread of French Invasion, was the following:—

"For the further security of the metropolis, a measure (which was some time since mentioned as intended) is now adopted, and even begun to be put in execution, which will effectually protect it, on the eastern side, for an extent of nearly twenty miles. A dam is to be constructed on the Lea River, which will enable Government, on the shortest notice of the landing of the enemy, to overflow the whole valley from near Ware to the Thames. The Surveyors were employed upon the business on Tuesday last, and the workmen are expected immediately to commence their operations."

This work was probably never actually begun. As other outcomes of the invasion scare, the Martello Towers were built round the coast at a prodigious cost, and then abandoned!

Sacred Fire.—The paragraph in the *Standard* for April 4th, 1904, is an interesting record of a survival. It illustrates the familiar quotation from Schiller:—

"Time doth consecrate,
And what is grey with age becomes religion."

"Fire and water were blessed with full ritual at the Westminster Cathedral on Saturday, in the presence of a large congregation. Outside the Cathedral fire was struck from a flint, and charcoal was lighted with it. Then Father Brown, as celebrant, blessed the new fire at the entrance to the church with five grains of incense, which were afterwards put into the Paschal candle. All the lights in the church were put out, to be relighted from the blessed fire. Following this ceremony was the blessing of the font, Monsignor Moyes reciting the prayer, "Oh God, whose spirit in the very beginning of the world moved over the waters," divided the water in the form of a cross, and flung some of it to the four quarters of the compass. Then, breathing thrice upon the water, he as many times lowered the Paschal candle into it. The ceremony concluded with the baptism of a new-born babe. Afterwards the bells, which had been silent since Maundy Thursday, were rung at the *Gloria in excelsis*."

¹ See *ESSEX NAT.*, xiii., 117-118.

METEOROLOGY.

Curious Effect of a Lightning Stroke.—At the meeting of the Royal Meteorological Society, on June 15th, the Rev. C. F. Box gave an account of some curious "Effects of a Lightning Stroke at Earl's Fee, Bowers Gifford, Essex, April 13th, 1904." A thunderstorm occurred during the early morning hours, and about 3 a.m. there was a blinding flash, lighting up the whole neighbourhood for miles around. followed immediately by a crashing explosion. One person stated that he saw what appeared to be a cylinder, and another person a ball of fire, descend and then explode, "casting darts" in all directions. On careful examination in daylight, it was found that in an oatfield, which had recently been dredged, there were three distinct sets of holes, ranging from nine inches down to about one inch in diameter. The holes, which were circular, diminished in size as they went downwards, and remained so on to the perfected rounded ends at the bottom. Upon digging sectionally into the soil, which is stiff yellow clay, it was found that the holes were "as clean cut as though bored with an auger."

Water-Spout at Brightlingsea.—"On Wednesday morning, July 27th, about 10.45, during the early part of a rather severe thunderstorm, a waterspout was seen to form in a southeasterly direction from Brightlingsea, over towards 'B' Martello Tower. It hung for from 10 to 15 minutes on the fringe of a very ominous-looking thunder-cloud, and then was seen to assume a feathery spiral form, and move about very violently in various directions. It then lowered its trunk-like end over St. Osyth Channel, and commenced to disperse itself just above 'The Pincushion.' It travelled over Cindery Island, and its great bulk was deposited in the middle of Brightlingsea Creek, near Underwood's Hard, opposite 'The Folly.' Its roar was heard a very long distance. It was believed to be from 30ft. to 40ft. through it, and it cast up its foam and spray at least 40ft. high. It was certainly a magnificent sight. Fortunately it was near high tide when it fell or the damage which would have been done to the oysters and oyster grounds must have been very serious. It is about 30 years since we observed a water-spout in this vicinity, and on that occasion it burst over what is known as 'Barker's Farm,' making a hole in a field big enough to contain a waggon and four horses."—*Essex County Standard*, July 30th, 1904.

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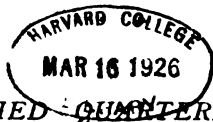
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OF THE
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EDITED BY
WILLIAM COLE, F.L.S., F.E.S.,
Honorary Secretary and Curator.

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BOYS' CHANGING CLOTHES STORE AT HARWICH.

ON THE NATURAL HISTORY OF PYRITES AND GYPSUM.

*Being the Presidential Address Delivered to the Essex Field Club at the
Annual Meeting on April 16th, 1904.*

By F. W. RUDLER, I.S.O., F.G.S., *President of the Club.*

(With Plate XII.)

THE Essex Field Club, over whose concerns it is my privilege at present to preside, is a group of some three hundred persons banded together by a common interest in the Natural History, the Geology, and the Prehistoric Archæology of this county. It is curious to note that while the term "Natural History" stands bound, literally, to cover the history of every department of Nature, it is a term which is often used now-a-days in so narrow a sense as to suggest its limitation to living things. A "naturalist" is commonly understood to be either a zoologist or a botanist, or both, but hardly a mineralogist. Natural objects which lack the fascination of life are apt to be kept outside the pale of natural history, as though minerals were rather beneath the attention of those who are attracted by the study of plants and animals. There may be some justification for drawing a sharp line between living things and lifeless things, but surely no shadow of justification for cutting off the Mineral Kingdom from the vast Empire which is embraced by the study of Natural History.

How we drifted into this practice of shutting our eyes to one great department of natural science and narrowing the meaning of the simple expression "Natural History" in a way which even if tolerated by convenience is clearly unjustified by logic, I never could discover. The name of that man who first had the coolness to shelve one-third of Nature is not, I believe, on record. I am anxious this evening to put in a plea on behalf of Mineralogy to take its place by the side of Zoology and Botany in the grand trinity of Natural Science.

It should, perhaps, be admitted at the outset that the mineralogist has himself largely to thank for the popular neglect of his science. Very little has been done, at least in this country, to place mineralogy before the public in an attractive form. So distinguished a mineralogist as Mr. L. Fletcher, the Keeper of

minerals at the British Museum, has confessed, with reference to this science, that "The pages of its text-books are sprinkled with wonderful formulæ designed by perverse chemists, and with unpronounceable hieroglyphics maliciously invented by cruel crystallographers."¹

With regard to the county of Essex it must be conceded that its mineralogy is of so meagre a character as to be far less attractive than its botany or its zoology. It may even be thought that minerals stand to Essex rather in the relation of snakes to Iceland. The case is hardly so bad as this, but still I am bound to confess that the mineralogist who visits Essex must not come hither with the expectation of finding himself in a happy hunting ground.

"This county," said Morant, "not having any large and high mountains, the usual parents and beds of *Metals* and *Minerals*, none of these are therefore to be look'd for here."² However, on the very next page of his work, in referring to the "Fossils of Essex" (and of course using the word "Fossil" in the comprehensive sense in which it was commonly used in his day—and with perfect etymological justification—so as to include minerals) he tells us that "what is found in greatest quantity is the Copperas stone or Pyrites." That is a statement which could hardly be improved by the best naturalist of the twentieth century, for it remains true to-day that in our meagre list of the minerals of Essex *Pyrites* occupies the first place.

And yet, curiously enough, this common mineral has sometimes been overlooked. In 1868 the late Mr. Townshend Hall, a personal friend of mine, published a work under the title of a *Mineralogist's Directory*, giving a list of British minerals arranged county by county. Under the heading of "Essex" there is no mention of Pyrites—the mineral products of the county being limited, according to this writer, to a single species—Gypsum, and its variety Selenite.³

The two minerals to which I have just referred—pyrites and gypsum—are almost the only well-marked species of which our county can boast, and the few observations which I am about to

¹ Presidential Address to the Mineralogical Society, *Mineralogical Magazine*, vol. viii. (1889), p. 141.

² *The History and Antiquities of the County of Essex*, 1768. Introduction, p. xxv.

³ *The Mineralogist's Directory, or a Guide to the Principal Mineral Localities in the United Kingdom of Great Britain and Ireland*. By Townshend M. Hall, London, 1868. (Essex p. 61.)

offer will therefore deal mainly with the natural history of Pyrites and Gypsum. These two minerals are well developed in the London Clay, and the London Clay is well developed in Essex.

PYRITES.

Concerning Pyrites a vast deal has been written. Nearly 180 years ago there was published in Saxony a remarkable treatise on this mineral, the work of a learned mineralogist, Dr. Johann Friedrich Henckel, of Freiberg. Henckel (or Henkel) was born at Merseburg in 1679, and after studying medicine at Leipzig settled down in the little mining town of Freiberg, where, yielding to the influence of his environment, he threw himself with enthusiasm into the study of minerals, metals, and mines. He was a voluminous writer. In 1725 he published the famous work to which I have referred under the title of *Pyritologia*. The author died in 1744, but a new and improved edition of the great treatise was published posthumously, and so wide became the reputation of the book that in 1757 *Pyritologia* was translated into English, and three years later into French.

In the preface to the English issue, the translator explains that the work should be welcomed by "those who are lovers of a solid knowledge of nature, the genuine result of observation and experiment." Now it strikes me that a "solid knowledge of nature" is exactly the kind of thing that will commend itself to the members of the Essex Field Club. No apology therefore seems necessary for introducing Henckel's work, especially as it is not likely to be familiar to any but those few folk who happen to be interested in the history of mineralogy.

Although Henckel's translator, holding of course a brief for his author, extols the *Pyritologia* as "a pattern worthy of copying after in our enquiries into Nature, and a just specimen of the method of induction," he is yet obliged to admit that the work is so prolix as to need a free exercise of editorial surgery in the matter of excision. In fact the editor drops the remark that Henckel is "certainly but an indifferent writer; diffuse to a fault, and generally very obscure and perplex in his manner of writing," with a "strain of low pleasantry and affectation of learning." This is certainly a formidable indictment and rather tends to repel the reader from attacking the great monograph; but though one dreads having to encounter an author who is "obscure and

perplex," I must confess to being rather attracted by his "strain of low pleasantry"; it is so different from what one generally expects in a learned mineralogist.

Perhaps the title itself is a good sample of Henckel's prolixity. Here it is, as given in the original :

PYRITOLOGIA, oder: Kiess-Historie, als des vornehmsten Minerals, nach dessen Nahmen, Arten, Lagerstätten, Ursprung, Eisen, Kupffer, unmetallischer Erde, Schwefel, Arsenic, Silber, Gold, einfachen Theilgen, Vitriol und Schmelztz Nutzung, aus vieler Sammlung, Gruben-Befahrung, Umgang und Brief-Wechsel mit Natur-und-Berg-Verständigen, vornehmlich aus Chymischer Untersuchung, mit Physicalisch-Chymischen Entdeckungen, nebst lebheften und nöthigen Kupffern, wie auch einer Vorrede vom Nutzen des Bergwercks, insonderheit des Chur-Sächsischen, gefertigt von D. Johann Friedrich Henckel, königl. Poln. und Churfürstl. Sächs. Land-Berg-und Stadt-Physico in Freyberg. Leipzig: 1725.

As the original work runs to upwards of a thousand pages, it is small wonder that the English translator cut it down pretty freely. Unfortunately, however, he omits Henckel's general observations on the study of natural science, since they have no direct bearing on Pyrites; but as Henckel was an educational reformer, distinctly in advance of his day, I feel inclined to rescue some of the original passages.

Henckel tells us that from early youth he had entertained a strong passion for the study of nature, and he soon saw that it was not enough to study books, or even to work in the cabinet; it was absolutely necessary, if progress were to be made, that he should go out into the field, and study nature in all her freshness. It is clear, therefore, that if Henckel were now living hereabouts, we should find his name on the roll of members of the Essex Field Club.

Himself a devout lover of nature, he could hardly understand why others failed to share his tastes. "Most people," he complains, "think more of a flower painted by a human artist than a flower fresh from the hands of Nature: they put the one into a gilt frame, while they trample the other underfoot." And among his words of wisdom, he counsels us to study with reverence the commonest natural objects around us. He has no patience with those who prize only what is rare—or as he puts it, those who are attracted by the lofty cedar of Lebanon, but will not deign to glance at the hyssop or the humble herb that springeth out of the wall. And then the enthusiastic pyritologist

pours out his vials of wrath on the heads of those who are favoured by fortune, yet waste their leisure and their wealth in idleness, utterly neglecting to profit by the study of nature. "Nature herself," he says, "seems to invite us to her school by the charm with which she surrounds the study of her works." I will not indulge in quotations from this grand old naturalist, but with some of his words ringing in our ears, borne to us across a gap of two centuries, we might fancy that we were listening to an advocate of Nature-Study in the twentieth century.

In the preface to the *Pyritology* Henckel says : "A principal motive to the present undertaking, in which I could wish to be imitated, is the improvement of natural history." So far, I feel sure, he has our Club entirely with him. Anything tending to the improvement of natural history certainly commands our sympathy. And no doubt Henckel's work did mark, at the time of its publication, a great advance in our knowledge of that department of natural history which deals with the world of minerals.

Pyrites was regarded by our author as the most important of all minerals, and on the title-page of the English translation the work is described as a "History of the Pyrites, the Principal Body in the Mineral Kingdom." To a substance occupying this superlative position we can scarcely grudge the thousand pages, or more, which Henckel, with Teutonic thoroughness, devotes to its study ; nor shall we even be disposed to quarrel with him when, in spite of the thousand pages, he apologizes for his work being so brief ! He is careful to explain that the magnitude of the work is by no means commensurate with the labour bestowed upon its production, for in some cases a few lines represent months of labour in chemical and other researches.

On the title-page of the original work the *Pyritologia* is described as a "*Kiess-Historie*," and to this day *Kies* is the German name for the mineral. Henckel suggests that this word may be connected with *Kiesel*, the name of flint, because both minerals may be used for striking fire. This certainly seems to be the case. In Pope's Greek-German Lexicon I find *πυρίτης λίθος* explained as "*Feuerstein, auch Kupfererz*." This *Feuerstein*, or "fire-stone," is the common word for flint. In Whitney's 'Century Dictionary' *πυρίτης* is defined as "a flint or

millstone." According, however, to Liddell and Scott, the original word, *πυρίτης* is an adjective, meaning "of or in the fire," and they define *πυρίτης λίθος* as "a mineral which strikes fire." Both flint and pyrites have therefore in some cases received the same name, because both may be employed for eliciting sparks.

Formerly pyrites was used for striking fire in muskets, just as flint was subsequently employed. In France both minerals were called *Pierre à carabinier*. This confusion between the two minerals gives point to the story which is told of the old French soldier, who, having heard that the stone became red after it had been heated, tried the experiment by subjecting a flint to calcination, whereupon he was of course disappointed by finding it become white! Calcined pyrites, it is true, yields red oxide of iron, but calcined flint only dehydrated silica. •

It is possible that the term pyrites, or firestone, may have also been sometimes applied to other spark-yielding minerals, such as emery. When we turn to the gossiping old Roman naturalist, Pliny, we find the word pyrites applied in such a way as to indicate several substances distinct from one another in chemical and in physical properties. Some was probably our Pyrites, for he speaks of a "fire-stone going under the name of Pyrites or Marcasin, which resembleth brass-ore in the mine." And again, to quote Holland's quaint translation, "in the ranke of these marcasines some range certaine stones, which we call *quicke fire-stones*, and of all others they be most ponderous; these be most necessarie for the espialls belonging unto a campe, for if they strike them either with an yron spike or another stone they will cast forth sparks of fire, which lighting upon matches dipt in brimstone, drie puffs or leaves, will cause them to catch fire sooner than a man can say the word."⁴

It has been suggested that man's first knowledge of fire may have been derived from the impact of pyrites and flint, two mineral substances which occur in the chalk. A nodule of pyrites and a nodule of flint accidentally brought into violent collision might startle primitive man by yielding sparks. I must confess, however, that I have never been able to elicit sparks in this way.

The wide application of the word Pyrites, by old writers, is

⁴ Book xxxvi., cap. xix. See note at the end of the paper.

well illustrated by Dr. Plot, the historian of Oxfordshire, who in reference to the term remarks that under this "*Genus* may be reckon'd not only *Fyrites* strictly taken, but *Flints*, *Pebbles*, *Sand*, and whatever else by any quick and sudden attrition may have its parts kindled into sparks."⁵

In consequence of readily giving forth sparks by concussion, pyrites was known to old writers by such names as *lapis igniarius* and *lapis luminis*. In Cornwall, where pyrites is common in the veinstones of the copper and tin-mines, it is generally called *mundic*, a word which Borlase, the historian of Cornwall, derives, though on what authority I know not, "from the cleanly shining appearance, both of its surface and structure."⁶ The "shining appearance," or metal-like brilliancy, is a character common to all the minerals which at present pass under the name of Pyrites.

In modern times the term Pyrites has come to be used by mineralogists as a family-name, embracing a group of native sulphides, all possessing a metallic lustre and a considerable degree of hardness, but not being strictly isomorphous—that is to say, they do not always crystallize in forms which are geometrically compatible with each other. The different kinds of pyrites are distinguished by prefixes, so that we speak of iron-pyrites, copper-pyrites, nickel-pyrites, cobalt-pyrites, and so forth. But since iron-pyrites is far and away the most common member of the family, it is this mineral which is always meant when the word is used without qualification. The name *sideropyrites* has sometimes been applied to iron-pyrites in order to distinguish it from *chalcopyrites*, or copper-pyrites.

Iron-pyrites is chemically a compound of iron and sulphur, termed *iron disulphide*, and we may regard each molecule as containing one atom of iron combined with two atoms of sulphur. Its formula is consequently FeS_2 , and its percentage composition 46.6 parts by weight of iron to 53.4 parts of sulphur. It is the sulphur rather than the iron that in most cases gives economic value to the mineral. Immense quantities are used for the manufacture of sulphuric acid—an application of the mineral which resulted from the action of the King of Naples in granting a monopoly of Sicilian sulphur to a French company, in the

⁵ *The Natural History of Oxfordshire*. By R. P., LL.D. Oxford, 1677, p. 71.

⁶ *The Natural History of Cornwall*. By William Borlase. Oxford, 1758. P. 131.

year 1838, whereupon the price of brimstone became so high that chemists cast about for some other source of sulphur, and found it at hand in the widely-distributed mineral—iron-pyrites. But as nothing is wasted now-a-days, much of the pyrites, after having yielded up its sulphur, is utilized for sake of its iron. If other metals are present so much the better. Thus, the vast deposits of pyrites in parts of Spain and Portugal contain a small proportion of copper, which is extracted by a wet process from the calcined pyrites; and then the residue, which contains the iron in the form of an oxide, passes to the iron-master, who knows it as “purple ore” or “blue billy.”

The pyrites found in Essex was formerly employed in the manufacture of copperas, and was therefore often called, as in the passage already cited from Morant, *copperas-stone*. Silas Taylor, in his well-known “History of Harwich,”⁷ tells us that—

“Upon this Shore also within the Flow of the Sea, are gathered as they are commonly call d *Copperas-stones* and carried to certain *Copperas-Houses* not far distant from hence. Where being mixed with Earth and disposed into light Beds, it dissolves by the Rain from the Sky, which Water being by Trunks guided into a great *Cistern* made of *Lead*, from thence is conveyed into a Boiler of *Lead*, which having perform'd its Operation upon it, produceth *Copperas*, which is a sort of *Vitriol*.”

In an engraving (here reproduced, Plate XII.) showing the shore at Harwich, boys are seen busily engaged in collecting the copperas-stones; and the editor, Samuel Dale, in describing what we should now call the London clay of Harwich, remarks that :—

“This Clay hath *Pyrites* or *Copperas-stones* sticking in it, but no *Shells* that I can observe. Dr. Plot in his *Hist. of Oxfordshire*, p. 52, takes notice that it was common in the blew Clays of that County to have the *Pyrites aureus* or *Brass-lumps* (which are Sorts of *Copperas-Stones*) mixed with it. And I have seen them among *Tile-Earth* at *Bocking*, in *Essex*; without doubt it is so in other Places.”

Referring to the copperas-houses, Dale informs us that in his day there were :—

“Divers in this County as at *Ramsey* three miles from hence. Also at *Walton*, Anno 1696, there were two, but one of them I hear since demolished by the *Sea*. There is also one at *Bricklesey*.⁸ The *Copperas-Stones* mentioned by our Author, are found upon all this Shore not only where the *Cliff* is gravelly,

⁷ *The History and Antiquities of Harwich and Dovecourt, in the County of Essex.* By Silas Taylor, Gent. To which is added an Appendix containing the Natural History of the Sea Coast and Country about Harwich, particularly the Cliff, the Fossils, Plants, Trees, Birds, and Fishes, etc. By Samuel Dale. 2nd ed. London, 1782.

⁸ The manufacture of Copperas in Essex is described by John Ray in his *Collection of English Words*, 1674.

but likewise where it is *loamy* or *clayie*; and this year 1728, I did not only gather them from there myself, but did likewise see divers *Boys* gathering them even at the Place where the Cliff is highest and most loamy; and as every Tide washeth away some of the looser Earth which falleth down from the Cavities of the *Cliff*, those Stones being most ponderous are there left; and as soon as the Tide permits they busily gather them."

It is interesting to learn from Dale that "The *Pyrite* of *Essex*, *Kent*, etc., yield upon Trial, a small quantity of *Gold* and *Silver*, and some of them a little *Copper*."

Referring to the nodules of pyrites in the cliffs of London Clay near Walton-on-the-Naze, Mr. Whitaker, writing in 1877, tells us that they were then still collected on the beach for the manufacture of copperas to the extent of about 150 tons a year.⁹

The term "copperas" naturally suggests that the substance so called contains copper, and this no doubt was originally the case. But the word gradually acquired an extended meaning, and, instead of being limited to copper sulphate, came to be applied also to the corresponding salts of other metals. Hence we recognise not only "blue copperas," or copper sulphate, but "green copperas," or iron sulphate, and "white copperas," or zinc sulphate—three salts known also respectively as blue vitriol, green vitriol, and white vitriol. But the strangest thing about the word "copperas" is that in the course of its history it has come to be almost limited to the iron-salt, so that the other compounds just mentioned are rarely called copperas at the present day. If we use the word "copperas" without any qualification we invariably mean sulphate of iron: in other words our copperas contains no copper. In Dr. Murray's great *National Dictionary* it is pointed out (*sub voce*) that the extension of meaning took place anterior to the appearance of the word in English, for iron sulphate was included under the Greek word *χάλκανθον* and the Latin *chalcanthum*. In the explanation of the term, however, there is a slight error, for reference is made to "the dissolving of iron by a solution of green copperas with deposition of its copper"—a passage in which the word "green" should obviously be "blue," for it must be the copper sulphate and not the iron-salt that is meant.

With regard then to the old copperas-houses of Walton, let

⁹ *The Geology of the Eastern End of Essex (Walton Naze and Harwich)*, Memoirs of the Geological Survey. 1887, p. 8.

us remember that even in their time the word "copperas" had escaped from the fetters of etymology, and that the houses were in no way connected with the copper industry.

Bishop Watson in his famous *Chemical Essays*, published in 1781, remarks in reference to pyrites that :—

"This mineral is called in some parts of England *Copperas stone* ; in others *brazil* ; in others *brass-lumps* ; in others *rust-balls* ; in others *horse-gold* ; in others *marcasite* ; though naturalists are now, I think, agreed to give that name to such mineral bodies as are angular and crystallized, especially with a cubic form. The scientific name is *Pyrites*—fiery."

Much of the pyrites occurring as nodules in clays, in shales and in the Chalk belongs to the kind which is now known as *marcasite*. In fact iron disulphide is a *dimorphous* substance, and forms two distinct mineral species, differing widely from each other in crystallographic characters. Common iron-pyrites crystallizes in the cubic system, generally in cubes, or hexahedra, less commonly in regular octahedra, and very characteristically in the form known as the pentagonal dodecahedron. That special dodecahedron, which is bounded by twelve regular pentagons is a well-known geometrical form, being one of the five Platonic solids ; but the pentagon of the crystal is not a regular figure, only four of its sides being equal, whilst the fifth is either longer or shorter than the others. This solid, with its twelve irregular pentagons, is so characteristic of pyrites that it was called by Haidinger the *Pyritohedron*. It is a hemihedral form of the four-faced cube, or tetrakis-hexahedron, from which it may be derived by development of the alternate faces. Another hemihedral form sometimes seen in pyrites is the dyakis-dodecahedron, a solid bounded by 24 equal and similar trapeziums. This form, known also as the diplohedron, is one of the semi-forms derivable from the six-faced octahedron. It is very notable that both the pentagonal dodecahedron and the diplohedron are parallel-sided hemihedral forms, that is to say, each face has an opposite corresponding face in parallel position, and this is so characteristic of pyrites as to be called *pyritohedral hemihedrism*.

The crystals of iron pyrites are in many cases bold, sharply-defined solids, which readily attract attention, and were recognized by certain old writers as "figured mundics."

But it sometimes happens that iron disulphide assumes crystalline forms totally different from those of the cubic system

—forms which are referable to what is now generally known as the orthorhombic system. Hence two distinct species have to be recognised. In 1845, Haidinger, a distinguished mineralogist in Vienna, suggested that the orthorhombic species should be called *Marcasite*, whilst the term *Pyrites* or *Pyrite* was reserved for the more common cubic species. This terminology is now generally adopted by mineralogists.

Unfortunately, however, there has been much confusion in the use of the terms, for some of the older writers employed the words in a sense quite different from our present usages, so that their *marcasite* is our *pyrites* !

For example, in the eighteenth century it was fashionable to wear what jewellers called “*marcasites*,” but these stones were really cubic pyrites, “*rose-cut*” and polished. Visitors to Ireland at the present day purchase shamrock brooches, and other trivial objects cut in pieces, of black shale, having the surface studded with brilliant little crystals of cubic pyrites. Curious superstitions associated with pyrites led to its being regarded as a stone related to the state of its wearer’s health, and hence it was known in Germany as the *Gesundheitsstein* or “*Health stone*.” When the wearer became sick the *marcasite* tarnished. The curious word *marcasite* is said to be of Arabic origin, having perhaps reached us by way of Spain. Some of the older writers had an easy way of settling its meaning: thus Borlase derives it from the verb *marcare*, to stamp—“a name,” he says, “proper enough for any fossil, which, for aught we know at present, has only the appearance, mark or outward testimonies of metal.” Those who are curious about the meaning and origin of the word *marcasite* will find a learned paper by Dr. Sadebeck in the *Neues Jahrbach für Mineralogie* for 1878, p. 289.

It is sometimes found convenient to extend the use of the word “*Pyrites*” so as to include both forms of iron-disulphide, the cubic species being then distinguished as *Pyrite*. Professor Alexis Julien, who has written much about these minerals, uses the term *pyrites* in a yet more comprehensive sense, so as to embrace not only *Pyrite* and *Marcasite* but also a third species of iron sulphide known as *Pyrrhotite* or *Magnetic Pyrites*. In like manner the “*Century Dictionary*,” defining “*Pyrites*,” says: “It is commonly called *Iron Pyrites*, which term, however, also includes the related orthorhombic species *marcasite* as well as *magnetic pyrites*, or *pyrrhotine*.”

It frequently happens that Pyrite and Marcasite, though not isomorphous, occur in intimate association, and it is certainly convenient in such cases to refer to the mixture as iron-pyrites. "In clay-beds," says Julien, "the pyritous nodules generally consist of successive crusts or transition mixtures of pyrite and marcasite." This remark is not without interest to us, inasmuch as the iron-pyrites of the London clay of Essex may often be of such a mixed character. Julien described the pyritic mineral of the well-known *Nipadites*, or fossil palm-nuts from the London clay of Sheppey, as "marcasitic pyrite," and says that some of the Sheppey fruits shew octahedra of true pyrite.

When Marcasite is well-crystallized, its forms are so distinctive, so very different from those of pyrite, as to be immediately recognised. Very commonly the crystals of marcasite are aggregations of what are called twin-crystals. Some of these groups present a shape which has led to the trivial name of *Cock's-comb pyrites*, whilst others have a suggestive resemblance to brass spear-heads, whence the term *spear pyrites*. The latter is the common type in the Chalk-marl between Dover and Folkestone, where according to Prof. Miers, "they are locally supposed to be the heads of Roman weapons."¹⁰

Whilst the two minerals marcasite and pyrite are thus readily enough distinguished when well crystallized, it is not always easy, in the absence of crystalline characters, to say off-hand whether a given specimen should be referred to pyrite, or to marcasite. It is true that marcasite is paler in colour, so that it is sometimes called *white pyrites*, but then by tarnish it is apt to become yellow, and so tends to resemble true pyrite. Strictly speaking it may be said that the three forms of iron-pyrites have characteristic colours; marcasite, or rhombic pyrites, being tin-white; pyrite, or cubic pyrites, being brass-yellow; and pyrrhotite, or rhombohedral pyrites, being bronze coloured. But these colours refer to pure and fresh specimens, and much of the marcasite seems to be impure; that is to say, it appears to be in intimate mechanical association with pyrite, and thus acquires a yellowish tint.

It has been said that the surest means of diagnosis is probably to be found in the specific gravity of the several minerals. According to Julien the density of normal pyrite is 5.01; of

¹⁰ *Mineralogy: an Introduction to the Scientific Study of Minerals*, 1902, p. 330.

normal marcasite about 4.8; and of normal pyrrhotite 4.6. But abnormal forms are not infrequent, and in these impure varieties the specific gravity may suffer disturbance of a more or less serious character, according to the proportion of impurity present. Prof. Julien's conclusions have been criticised by Mr. H. N. Stokes in his valuable paper published as a "Bulletin" of the Geological Survey of the United States, No. 186.

Of the native "sulphides" iron-pyrites, speaking broadly, is one of the most unstable, but the different kinds of pyrites vary greatly in their stability. Some of the pyrites from mineral veins and from crystalline rocks is indeed durable enough, and specimens of mundic, after exposure for years on the burrows or waste-heaps of a mine, may still preserve a bright and brassy appearance. Sharp cubic crystals in clay-slate also are often resistant. But such cases are not very common. As a rule marcasite seems much more prone to alteration than pyrite. Thus the marcasite found in coal, lignite, clay-shale and chalk readily suffers decomposition. The instability has been referred by some authorities to the presence of foreign impurity, such as arsenic or to the unstable proto-sulphide called troilite, whilst others have connected it with the state of aggregation of the mineral. Prof. Julien's study of the subject led him to the conclusion that "difference of chemical composition has nothing to do with the tendency to decomposition." It is more probably connected with the molecular constitution of the mineral.

Two distinct types of alteration may be recognised. In the more familiar mode of alteration the pyrites suffers conversion into brown oxide of iron. Many nodules and some crystals, on exposure to moist air, become coated with this brown substance, which is a ferric hydrate, or iron-hydroxide, known to mineralogists as *Limonite*. The change proceeds slowly from without inwards, and if continued long enough, the entire mass of the mineral may become transformed. As the limonite has practically the same volume as the pyrites from which it originated, there is usually little or no change of form, so that a perfect pseudomorph is obtained. Most mineral collections contain beautiful pseudomorphs, which, though consisting more or less completely of limonite, retain with perfect fidelity the smooth faces and sharp edges, and even the characteristic striæ on the crystal-faces of the original pyrite. Such altered crystals

are sometimes known from their liver-brown colour as *Hepatic Pyrites*.

In mineral-veins, where pyrites is often abundant, the production of iron hydrate gives a rusty appearance to the vein stone, and in the case of quartz reefs it suggests a kind of calcination leading to the term "baked quartz." By removal of the pyrites, cubic cavities are left, containing more or less ochreous iron-ore. Where the pyrites is auriferous, the precious metal by resisting meteoric influences may remain in the form of sprigs or plates or grains, and hence it comes about that native gold is frequently found in the rusty quartz. Professor H. Louis has called attention to the fact that the iron sulphide in gold-reefs is invariably cubic pyrite—never marcasite.¹¹

The "Essex gold mine," often referred to by old writers, was no doubt mythical. Yet it is not unlikely that some of the pyrites of this county may contain a trace of the noble metal. We have already seen that Dale refers to its existence. He may have been right; yet there is no reason to suppose that the pyritic minerals of the south-east of England contain more than a minute proportion of gold, if any. Old Sir John Pettus in his "Essays on Metallick Words," published in his *Fleta Minor*, in 1683, says, "they are excellent *fire-stones* which we find in our *mines* in *England*, but not so good for *fire-locks* as those which are brought from Germany, etc. And our *Marcasites* do neither afford *gold* nor *silver* worth the charge."¹²

In mineral veins the alteration of the pyrites into limonite occurs only in the upper part of the lode, above the water-level of the country, or in what Posepny has called the *Vadose* region. Below the plane of saturation, the metallic sulphides may retain their original character. The decomposition of the pyrites on the "back," or outcrop of the vein, gives rise to that ferruginous mass which the Cornish miner calls "*Gozzan*," and the Continental miner the *Chapeau de Fer* or the *Eiserner Hut*. Probably in many cases ferrous carbonate is formed as an intermediate product in the production of ferric hydrate.

¹¹ "On the mode of occurrence of gold." *Mineralogical Magazine*, vol. x. (1893), p. 241.

¹² The title of this book *Fleta* has reference to the Fleet Prison, in which the work was written by Pettus, whilst confined, as he put it, "for my being too kind to others, and too unjust to myself." As there was a legal work entitled *Fleta*, also because written in the prison, the term *minor* was added by Pettus partly for sake of distinction and partly as a play on the word *miner*. Pettus's puns were exceptionally weak.

The tendency to limonitization, though common enough in some kinds of pyrite, is even more marked in marcasite. Thus, the well-known nodules from the chalk, often called "thunderbolts" and "fairy balls," are usually converted superficially into limonite, so that the appearance of the globular masses is rather suggestive of rusty cannon-balls. In some cases the ochreous oxide forms only a thin brown rind, whilst in others it may occupy the greater part, or even the whole, of the nodule. If there is any fissure, the meteoric agents may gain access to the interior and attack the mineral in the immediate neighbourhood of the crack. The nodules tend to break readily in the direction of the radiating fibres, and these fibres lose their brass-like appearance when atmospheric influences penetrate along the planes of weakness.

Not only may pyrites suffer hepatic alteration, or *limonitization*, but it may also undergo a saline decomposition, sometimes called *vitriolization*. This type of change is sometimes very conspicuous in marcasite, and, as every one knows, is a source of great inconvenience to the collector of pyritized fossils. The iron sulphide in the presence of moist air becomes oxidised to ferrous sulphate, which is the salt known, when formed naturally, as *melanterite*, and when formed artificially as "green copperas" or "green vitriol." There is also frequently formed, concurrently with the melanterite, free sulphuric acid; and to this product may be ascribed the corrosive action too often seen in our cabinets and museums. The labels, the cardboard trays, even the wooden tablets and the drawers themselves, may be attacked more or less seriously by the action of this acid eliminated by the decomposition of the pyritous fossils.

Although the name melanterite suggests a black mineral, the ferrous sulphate is normally green. Being a very unstable body, it tends to pass readily into the state of ferric sulphate, or persulphate of iron, a yellowish substance often seen as an incrustation or efflorescence on rocks containing decomposing pyrites. Moreover the ferrous sulphate also passes by oxidation into the condition of ferric hydrate, as seen in common copperas on exposure to air.

It should be noted that Mr. H. N. Stokes shows that the old notion that marcasite tends to saline change and pyrite to limonitization is quite untenable. He has observed rapid

vitriolization in pure pyrite. Moreover he finds the fibrous structure, contrary to usual belief, much more common in pyrite than in marcasite.¹³

During the oxidation of pyrites heat is evolved, and cases have occurred in which bituminous shales rich in pyrites have caught fire spontaneously from this cause. A famous case occurred in the cliffs of Kimeridge clay at Ringstead Bay, opposite Weymouth, in the autumn of 1826. The alum-shale of Whitby is a bituminous pyritic rock in the Upper Lias, which owed its economic value to the ready decomposition of its pyrites.

Iron-pyrites is a common mineral in beds of coal, and the oxidation of the pyrites when the coal is stored in the bunks of ships has often given rise to so elevated a temperature as to contribute to the spontaneous combustion of the coal, especially in hot climates, as when vessels are passing through the Red Sea. The actual cause of ignition, however, is probably to be sought elsewhere.

The pyrites is often seen in brassy films on the joint-faces of pieces of coal in the domestic scuttle. Darwin, in his "Botanic Garden," has a poetic reference to this pyrites:

"Hence sable coal his massy couch extends
And stars of gold the sparkling *Pyrite* blends."

The mention of "stars of gold" reminds us that the inexperienced prospector has occasionally mistaken pyrites for the precious metal; and hence in mining camps, where speech is apt to be more direct than courteous, the mineral has been called "Fool's Gold."

In coal mines the nodules of pyrites are often known as "brasses," though a so-called "brassy coal" in some cases contains very little pyrites. In certain collieries the pyritic lumps are picked out, and sold for sulphuric acid manufacture. The coal brass is usually marcasite and not true pyrite, though cubic crystals are occasionally found.

It is worth noting that pyrites occurs in coal not only in brass-like lumps and bands, but also in a finely-divided form, so intimately associated with the coal that it fails to appeal directly to the eye; in this form it has been called "black pyrites."¹⁴

¹³ *Bulletin of U. S. Geol. Survey*, No. 186, 1901.

¹⁴ *Royal Commission on Arsenical Poisoning*, Blue-book of Evidence, vol. II., 1903.

In the Coal Measures, the pyrites has no doubt been derived from circulating ferruginous waters by the reducing action of the carbonaceous matter. A similar origin may account for the pyrites found elsewhere in connexion with organic structures, as in the fossil wood occurring in the cliffs of Walton-on-the-Naze. Solutions of iron salts, like the carbonate in carbonated water, brought into relation with sulphates in the presence of decomposing organic matter might readily yield pyrites.

Bischof, the great chemical geologist, obtained pyrites by adding sugar to a solution of sulphate of soda containing a little iron, and allowing a pitcher of the liquid to remain in a cellar for four years. A well-known case of the formation of pyrites was that cited a century ago by Pepys, who having prepared hydrogen by the action of dilute sulphuric acid on iron filings, left a jar of the by-product in his laboratory for a year, and then found that some unfortunate mice which had fallen into the liquid had effected its reduction to the condition of sulphide, in the form of pyrites. In nature, ferrous sulphate may occur in percolating waters and readily suffer reduction by any decaying organic matter with which it may come in contact. But in such cases the sulphate itself may have been derived from the oxidation of pyrites elsewhere ; so that the changes are cyclic.

Pyrites sometimes occurs crystallized in alluvial deposits of recent age, and is found in the muds forming around the coasts at the present day. According to the report of the *Challenger* the colour of the "blue muds," which are frequently found either in the deeper waters around continental land or in enclosed seas, is due to organic matter and to sulphide of iron in a fine state of division. When first dredged, it emits the odour of sulphuretted hydrogen.

Annelids pass mud through their alimentary tract, and during its passage any sulphates may be reduced to sulphides.

The bluish colour of certain clays like the gault, and some of the Jurassic limestones like the Forest marble, is usually connected with the presence of finely-divided iron-pyrites.

The decomposition of pyrites often contributes to the mineral character of waters percolating through rocks in which it occurs. It is curious to find that Harrison, the good old rector of Radwinter, in Essex, in writing in his quaint history, more than three hundred years ago, about the waters of Bath, refers their

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character to the presence of pyrites: "That these baths or waters are derived from such, the marchasites which the Grecians call *Pyritis*, *per antonomasiam* (for being smit with the iron, it yeeldeth more sparkes than any flint or calcedonie, and therefore seemeth to deserve the name above the rest), and besides these other stones mixed with some copper, and dailie found upon the mountains thereabouts, will beare sufficient witness, though I would write the contrarie."¹⁵ Harrison was no chemist and was probably wrong about the pyrites, but still he had wit enough to connect the character of the water with the nature of the minerals below.

Respecting the saline, or vitriolic, decomposition of pyrites, it is amusing to hear the opinion of Henckel, and the passage in which he attempts to explain it is a good example of the old doctor's verbosity:—

"Here we must premise something on the internal causality, or how the spontaneous *vitriolisation* of *pyrites* happens internally. Philosophers might call it *magnetism*, to denote a mutual action of damps and juices, on the side of the patient, namely, the *pyrites*, consisting in a *receptivity*, and on the side of the agent, or air, in an influx."

With the quotation of this "perplex" passage, I feel tempted to close my remarks on Pyrites, merely adding that notwithstanding all that has been written about this simple mineral much still remains obscure. "No facts in chemical geology," said the late Professor Newberry, "are more interesting and mysterious than those connected with Pyrites."

GYPSUM.

Just as Pyrites is the most common of our natural *sulphides*, so GYPSUM is the commonest of all the *sulphates*. Between the two minerals an intimate association can often be traced. On the saline decomposition of pyrites, sulphuric acid is produced, and by the action of this acid upon calcareous matter calcium sulphate is readily formed. Gypsum is merely this sulphate in a hydrated condition. Hence the marcasite of the chalk may be accompanied by gypsum, the direct result of its own decay. So too, in the London clay, and in other argillaceous rocks, the acid of the decomposing pyritic mineral may re-act on the carbonate of lime of shells and other calcareous structures of organic

¹⁵ *Harrison's Description of England*. Edited by F. J. Furnivall for the New Shakspeare Society. Part I. (1877), p. 352.

origin—and thus it comes about that we may sometimes search for fossils, and find only crystals of gypsum. The appearance of the gypsum is in truth correlative with the disappearance of the fossils. Less commonly the acid from the disintegration of the pyrites attacks the silicate of alumina in clay, and so produces an aluminous sulphate, like the mineral known as *Websterite* or *aluminite*.

In an old journal entitled *The Mining Review* there appeared a series of articles on "The Mineral Topography of Great Britain," by Mr. A. W. Tooke, M.A., F.G.S., and in the number for February, 1837, the minerals of *Essex* are enumerated. Excluding rocks, which are not here separated, the *Essex* minerals include iron-pyrites, copper-pyrites (which can have been only occasionally, if ever, found) and selenite, or crystallized gypsum. With regard to the selenite the following local information is given :

"Upon the sea-shore, between Little Holland and Harwich, copper-pyrites and selenite, there called Frinton glass, from being most plentiful opposite that village."

Probably the good folk of Frinton never used this "glass" for glazing their windows, but, ages before Mr. Tooke wrote, the mineral was undoubtedly employed elsewhere for a similar purpose. It is said that the *Lapis Specularis*, which most authorities believe to have been gypsum, was introduced at Rome in the time of Seneca, and that Tiberius got cucumbers at his table almost every month in the year by using it for the protection of the plants. Pliny, describing this glass-stone, cites the opinion of certain authorities to the effect that it was (to borrow from the old translator, Holland) "a liquid humour of the earth, congealed to an ice after the manner of crystal." And to this day workmen are in the habit of calling crystals of gypsum "congealed water." Samuel Dale, in referring to the selenite of Harwich, calls it "Mock Crystal," composed of the same material as *Talc*. "Certaine it is," said parson Harrison, "that antiquitie used it before glasse was knowen, under the name of Selenites."

Transparent gypsum is still called *Selenite*—a word supposed to express the character of the lustre exhibited by the mineral on its cleavage-planes. This lustre has been compared to the soft brightness of moonlight, and hence the word selenite or

"moon-stone." But the mineral is to be carefully distinguished from the "moonstone" of the jeweller, which is an opalescent adularia, and therefore much harder than gypsum. Gypsum, or selenite, is indeed so soft as to be readily scratched, even by the finger-nail, and hence when fibrous gypsum, or *satén spar*, is cut and polished as an ornamental stone, for sake of its sheen, the material suffers from the slightest abrasion.

Selenite crystallizes in what is called the monoclinic, or singly-oblique, or monosymmetric system, and the crystals present perfect cleavage parallel to a certain form which is termed the *clinopinacoid*. In the most common type of crystal, the plates which are cleaved parallel to this form are diamond-shaped. It has been suggested that the small lozenge-shaped plates of glass so common in old-fashioned casements represent a survival of the cleavage-plates of selenite used in days before glass was common. Even after glass came into general use for windows, selenite continued to be used in certain religious houses. Such plates, by reason of their softness, soon lost transparency and behaved rather like ground glass—a decided advantage in places which required a "dim religious light." The mineral is still called in Germany *Marienglas* or *Frauenis*.

Probably the largest known crystals of selenite are those from the cave, or goede, in Utah, whence Dr. J. E. Talmage obtained the specimens which he has so generously distributed in this country. Much nearer home there is the well-known Marienglashöhle of Friedrichroda, which presents an example of a grotto with selenite forming the sparry garniture of roof and wall. This cave is situated near the great ducal castle of Reinhardsbrunn, not far from Gotha, surrounded by the pine-clad hills of the Thüringer Wald. A cottage near the entrance offers the miners' greeting, "*Glück Auf!*" but let no visitor be tempted by the beautiful crystals to use his hammer, for over the doorway hangs the not unnecessary notice, "*Das Abbrechen von Marienglas ist streng verboten!*"

Magnificent specimens from this locality may be seen, however, in the British Museum, and smaller examples in the Museum of Practical Geology—the specimens in both cases having been presented by the Prince Consort. It is curious to note how some of these fine crystals are bent and contorted as though they had been at one time plastic as sticks of warm sealing-wax.

This selenite of Friedrichroda is in Permian rocks, and it is notable that the greatest deposits of gypsum in our own country also occur in the New Red Sandstone formation. At Newark in Nottinghamshire, at Fauld in Staffordshire, and at Chellaston in Derbyshire, gypsum is, or has been, very extensively worked in the Keuper marl, whilst in the north of England the mineral occurs, as Mr. J. G. Goodchild has pointed out, at a lower horizon.¹⁶ The gypsum of our New Red rocks is mostly in the granular form called *alabaster*, and, with its veins and cloudings of iron oxide, is valued as an ornamental stone, especially for internal ecclesiastical decoration. As it is extremely soft it is carved into elaborate forms much more readily than true marble.

These great masses of alabaster, occur as balls, or lenticular cakes, or irregular beds, in the marl,¹⁷ and often enclose cavities, the walls of which are studded with crystals of selenite, not unlike those disseminated through many clays. In the Triassic and Permian rocks, however, the gypsum seems to have been precipitated from the salt water of lakes, which received the inland drainage of a region probably of desert-like features; or it may perhaps have been deposited in a land-locked sheet of water, representing an arm cut off from the sea.

Large deposits of gypsum occur not only in the Midlands and the North of England, but also in the south-east, notably in the Purbeck beds of Sussex. Here it was discovered by the famous sub-Wealden boring at Netherfield, near Battle, commenced in 1872 to commemorate the visit of the British Association to Brighton. At the present day this gypsum is largely worked, chiefly for conversion into "Plaster of Paris"—a use to which much of our gypsum elsewhere is applied. By careful calcination a large proportion of the water of this hydrous sulphate is expelled, and the partially dehydrated gypsum becomes a valuable material, of wide application in the industrial arts. If all the water be expelled the mineral has the composition of *anhydrite*, and becomes spoilt as a cement, being as the workmen say, "over-burnt."

The gypsum of the London clay, although occurring

¹⁶ An admirable account of gypsum will be found in Mr. Goodchild's paper entitled "Some Observations upon the Natural History of Gypsum." *Proceedings Geologists' Assoc.*, Vol. X., p. 425. For the selenite of Utah see *Rep. Museums Assoc.*, 1897, p. 47.

¹⁷ "The Gypsum Deposits of Nottinghamshire and Derbyshire." By A. T. Metcalfe, *Trans. Fed. Inst. Min.*, Vol. XII. (1896), p. 107.

sometimes in beautiful crystals, is never abundant enough to be of economic value. Similar crystals occur in many other clays like the Gault and the Kimeridge clay. It is the latter formation which yields the fine crystals for which the Headington pits, near Oxford, are famous. With reference to the formation of these crystals, Professor Phillips regarded them as "still in progress of growth,"¹⁸ a remark which may also apply to the crystals in our London clay. Minerals, let us remember, have their periods of growth and decay, and in fact pass through a kind of life-history.

Nearly forty years ago the late Professor P. M. Duncan called attention to the decay and disappearance of crystals of selenite in the London clay of the Tendring Hundred in Essex. The clay enclosed definitely-shaped cavities, which had evidently been occupied at one time by stellate crystals of selenite. Gypsum is a fairly soluble substance, but it was held that the crystals of selenite in this case had been removed not by simple solution, but by chemical decomposition. Selenite in the neighbourhood of decaying organic matter might readily suffer deoxidation, and the sulphate would thus become reduced to the state of sulphide. Calcium sulphide is a very unstable body, and may easily be removed. In the presence of water, the sulphide evolves sulphuretted hydrogen which may, by oxidation, yield sulphuric acid. Then this acid acting on carbonate of lime will regenerate gypsum, and so the cycle of changes goes on—the death of one crystal being followed by the birth of another.

Moreover, when calcium sulphide, formed from gypsum by decaying organisms, comes into relation with a solution of acid carbonate of iron, such as must often be present in waters circulating through the upper part of the earth's crust, a reaction is set up, whereby iron sulphide and calcium carbonate are produced. Curiously enough then it appears that pyrites may be formed from the decay of gypsum.¹⁹

That pyrites is at present in course of formation, under certain conditions, is a well-known fact, and examples of recent pyrites have frequently been cited. Even Borlase, the

¹⁸ *Geology of Oxford*, 1871, p. 325.

¹⁹ See Prof. A. Lacroix's fine monograph: *Le Gypse de Paris et les Minéraux qui l'accompagnent.* *Nouvelles Archives du Muséum d'histoire naturelle*, 3 me. série, t. xl. Paris, 1897, pp. 201 to 294.

historian of Cornwall, though of course with scarcely any knowledge of chemical geology, was acute enough to see this, for he remarks : " There is good reason to believe that mundics are perpetually forming," and then, after giving instances, he goes on to observe that " The mineral principles are always active and forming new concretions."

It was seen, in an earlier part of this address, that gypsum is often formed by the reaction of decomposed pyrites on calcareous matter ; it is now seen that, conversely, pyrites may be formed from the reaction of decomposed gypsum on ferruginous solutions. Nothing surely can better illustrate the intimate relationship between these two minerals, or explain why they are often found associated in the clays of Essex.

Allow me, in conclusion, to congratulate the Essex Field Club on the attention which is at present being given to the arrangement of the mineralogical collection in its Museum at Stratford. My friend, Mr. T. W. Reader, is good enough to sacrifice much time in co-operating with Mr. W. Cole in overhauling this department of the museum. Let us hope that before the revolving year brings round another Annual Meeting we shall see, as a result of Mr. Reader's valuable labours, all our specimens of minerals and rocks not only accurately determined and scientifically classified, but well displayed and neatly labelled in the cases of our Museum. It is true that from what we have seen this evening we can hardly expect the local minerals to make a brave show, and in order to gain a comprehensive view of the natural history of the mineral kingdom it is necessary to travel outside our county. The mineral collection of this Institution is therefore a general collection ; and when properly exhibited it will be found to include some of the most beautiful, the most instructive, and the most marvellous objects in the whole realm of Natural History.

Note referred to on page 310.—Dr. Philemon Holland the translator of Pliny, was an Essex man, having been born at Chelmsford in 1552. His industry in translating the classics led to his being styled " translator general of his age." Pope refers to the " groaning shelves " weighed down by his ponderous folios.

EVIDENCES OF PREHISTORIC MAN IN WEST KENT.

By J. RUSSELL LARKBY.

[Read January 30th, 1904.]

WHEN your Secretary kindly asked me to read a paper before the Club, I felt the difficulty of two possible disabilities—that, both my implements and area being non-local, they might lose something of their interest; also, the subject of Eolithic implements having been ably dealt with by one of your members, their interest might suffer deterioration. As, however, I am confident you will agree with me that the evidence of man is always worthy of attention, I propose to place before you some remarks as to the bearing of the evidence produced by a careful search in a small area west of the River Darent.

It is unnecessary for me to weary you with any extended notice of that great earth movement known as the elevation of the Weald, or to do more than remind you that the upheaved area has been planed down, mainly by extinct and existing rivers, to an undulating country presenting a series of beautiful and richly wooded ridges. These ridges are bounded in the north by the North Downs, masses of white chalk rising above the less resistant beds of the Weald. At the top of the chalk of the North Downs, there still exist fragments of the once continuous Tertiary deposits, and overlying them is the well-known plateau drift, the material from which has been wrested another monument to the greater antiquity of man. These patches of gravel therefore represent the deposits of ancient rivers—rivers whose catchment basins existed on the now denuded heights of the Weald. The plateau gravels contain fragments of chert, Oldbury stone and Pliocene ironstone, all of which owe their elevated position, far above the outcrop of those rocks, to the action of rivers running almost due south to north. A remarkably constant feature in Eolithic gravels is the deep ochreous staining caused by long contact with those ferruginous beds which enter so largely into the structure of the Weald. It is therefore possible to single out many of the flints found in valley gravels as derivatives once forming a part of the high level gravels of a now extinct river system. At the same time it is not advisable to insist too strongly on ochreous staining

as a reliable test of age, as, owing to purely local circumstances, it is quite possible that the discolouration may belong to a much later period.

We will now proceed to an examination of the area which for some eighteen months I have carefully examined and noted, namely, that of Well Hill, Shoreham, as it illustrates to a very accentuated degree the great antiquity of the high level gravels belonging to the S. to N. rivers of the Weald. The elevation known as Well Hill rises to a height of 610 feet O.D. and forms the culminating point of the immediate vicinity. (See Section, Fig. 1.) The most striking feature of the elevation is that on the summit (610 feet O.D.) there is a thick and well-marked

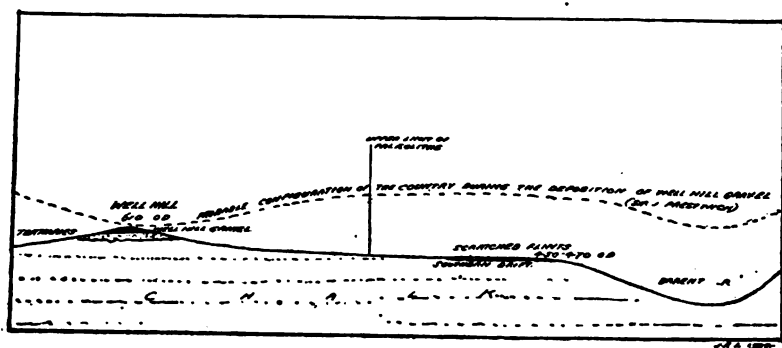


FIG. 1.—SECTION OF WELL HILL, SHOWING THE RELATIVE POSITION OF EOLITHIC AND PALÆOLITHIC GRAVELS.

deposit of flint gravel packed in a matrix of loose quartz sand. That the gravel is one of great antiquity, older, perhaps, than the drift on the Downs, is suggested by its much wasted condition, making it useless as road metal, and the absence of *debris* from the Lower Greensand; this latter point, first noticed by the late Sir Joseph Prestwich, is of some importance, as showing that at the time of the deposition of the Well Hill gravel the rivers had not cut their channels through the chalk. The simple composition of the gravel well confirms the antiquity assigned to it; the flints are only slightly iron-stained, and instead of the clay matrix of the Downs, there exists the sharp, crisp sand, showing clear evidence of the break-up of the Tertiaries once existing to

the south. The Well Hill gravel is, therefore, of great interest, at all events in a local sense, as illustrating one of the early results of the sub-aerial denudation of the Weald. It is interesting to note in passing that green-coated flints are fairly abundant on the summit, thus showing the break up of the

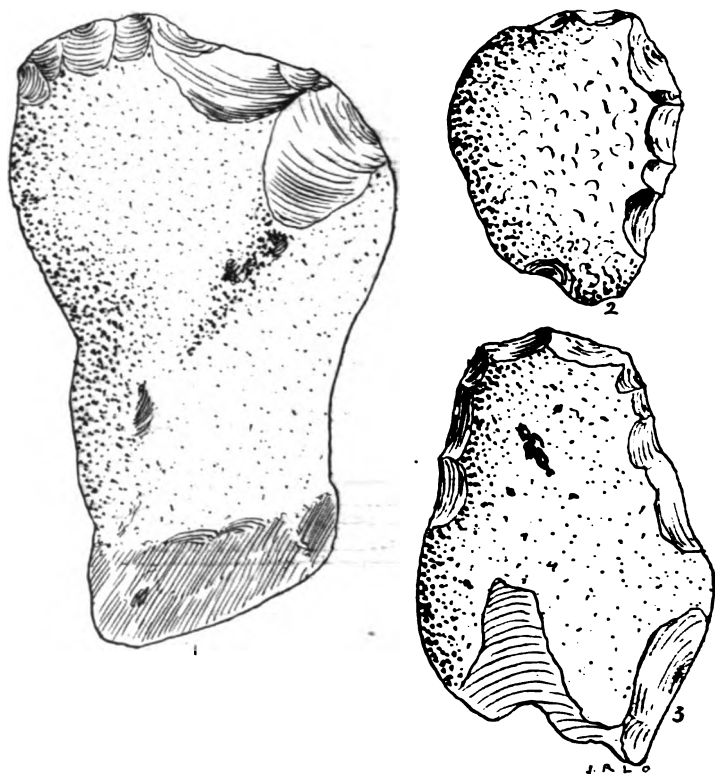


FIG. 2.—SCRAPER TYPES (FULL SIZE) ROLITHIC GRAVELS, WELL HILL, KENT, 600 FT. O.D.

1. Large cylindrical flint, bulbous on other side. Definite work on the scraping edge.
2. Split pebble (Lower Tertiary), worked on the side. Crust bleached. Chipped surface stained a light amber colour.
3. Sponge flint, with definite work. Crust bleached. Chipped edges stained a dark brown.

Thanet Sands once existing to the south ; on the hill itself the junction between Thanet Sands and Chalk is still preserved, as in one locality *Melania inquinata* may be picked up on the surface, quite unprotected by any top soil. There has been, I think

some little doubt as to the true character of the plateau drift on the Downs, and the opponents of Eoliths have not been slow in casting doubts as to its antiquity. At Well Hill, however, the river origin of the gravel cannot be doubted, and I have had



FIG. 3.—POINTED EOLITHS, WELL HILL.

1. From summit, 610 feet.
2. From trailed material, 450 feet O.D.

satisfaction in finding in this ancient deposit some interesting implements, now placed on the table for inspection. (Figs. 2 and 3.)

I do not think I can better illustrate the antiquity of this

gravel than by stating that the Well Hill river seems to have found its base level at 610 feet O.D., whilst the Darent still pursues its course and is still capable of denudation at 150 feet O.D.

Another point our opponents have not been slow in using is the fact that on the surface of the North Downs—the classic station for Eoliths—implements of all types and in all stages of bleaching occur in association, claiming, therefrom, that no reliance can be placed on what are merely surface finds. The total lack of even early Palæolithic forms and the occurrence of typical Eoliths only in the sections there exposed by Mr. Harrison have curiously enough suffered entire negligence. On broad grounds it is quite possible to distinguish between the ages of various surface implements, although obviously the position made from such evidence cannot be put forward as conclusive. But although various types are found in close association on the surface of the Downs, what is true there may not apply to other stations. So far as my experience is concerned at Well Hill, the summit-level, or that part of it available for search, is totally unproductive of any evidence for Palæolithic man; this is all the more noticeable, as on the lower levels of the hill I have found Palæolithic and Neolithic flakes and implements not in scores, but in hundreds. This isolation of Eolithic implements on the highest level of the district is surely of some importance in the question of the antiquity of the various types of worked flints. It should be remembered, however, that the plateau or Eolithic types are not necessarily confined to the highest levels in any one district, as owing to prolonged denudation they have been transported to lower ground; a fact again supporting their antiquity, for they occur as derivatives in deposits which are themselves of great antiquity. It is necessary to take every care in defining the limits of the plateau gravels. There is, it seems to me, a tendency to regard every deposit containing Eoliths as Eolithic or plateau drift—a course fraught with danger when it becomes necessary to prove the antiquity of the true high level gravels. Remembering that the deposits of the Wealden rivers have been subjected to a long period of denudation during the cutting of the east to west channels, it is quite possible that the Eoliths now found on lower levels are really there by the denudation going on whilst man was in the Palæolithic stage of his progress.

This suggestion is strengthened by the occurrence of Eolithic and Palæolithic types in close association. This association of types has already served as evidence against the authenticity and not the antiquity of Eoliths.

Professor Boyd-Dawkins (*Journal of Anthropological Institute*, April, 1903), in reviewing the *Guide to the Antiquities of the Stone Age*, issued by the Trustees of the British Museum last year, maintained that because the types are found in association they are necessarily of the same period, the conclusion naturally arrived at being that Eoliths do not represent any outlay of man's handiwork. It is possible to view the association of type from a different standpoint. The passage referred to is as follows;—"The question therefore as to whether the Eoliths are natural flints used by man or artificially made tools, is of no special importance, because Palæolithic man, the maker of advanced implements, was then in the land and would certainly have used primitive types if they suited his purpose." Now the ground on which the objection is placed is that in the Prestwick Collection there are three specimens labelled "Palæolithic implements found with plateau gravel specimens, Shoreham, Kent." It is possible, however, that the occurrence of the two types in association neither detracts from the age of the Eoliths nor increases the antiquity assignable to the Palæoliths as both may have been under the influence of river action, with the difference that the Eoliths constituted a part of the area to be denuded, whilst the Palæoliths were made during and after the break-up of the Eolithic gravels. It is difficult to decide the earliest date of any of the constituent materials of a river gravel, as the deposit is collected from various areas of widely divergent ages; it seems more reasonable to look on the deposit as illustrating only the *latest* period to which a river carried its denuding action.

If plateau evidence is required, then we must go to the plateau gravels, and when Eoliths and Palæoliths are there found in close association in the plateau drift, it may perhaps be necessary to revise the claim for the greater antiquity of Eoliths. I do not think it requires one of the greater prophets to foretell the unlikelihood of such a revision.

If the claim for contemporaneity of type should be substantiated, it will still be necessary to explain away the evidence

given by a certain intermediate type of implement lacking the deep staining of the Eoliths, and yet obviously earlier than the earlier Palæoliths (Fig. 4). I have brought for your inspection

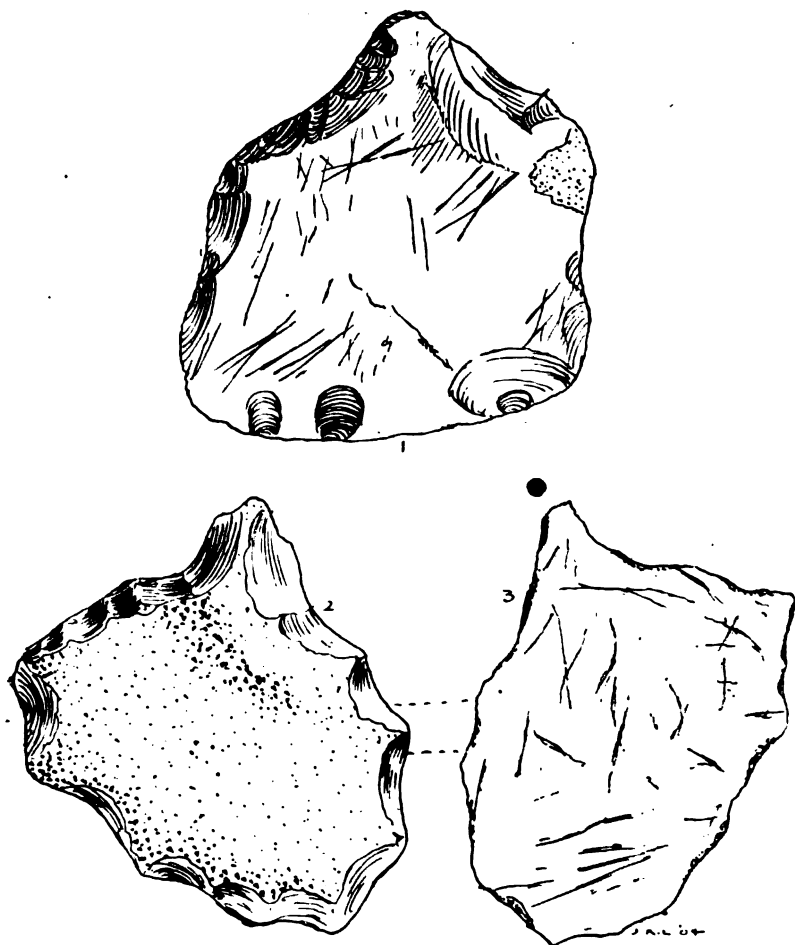


FIG. 4.—LATE EOLITHIC IMPLEMENTS, COCKERHURST FARM, WELL HILL, 450 FT. O.D.
1. Unstained and unrolled. Scratched on both sides.
2.—3. Two views of unstained implement, deeply scratched.

presently a small series of these intermediate flints, all from the 450-470 levels at Cockerhurst Farm on the flanks of Well Hill. It is unfortunate that so far but little attention has been paid to

these interesting flints—a circumstance owing probably to their insignificance both in numbers and appearance. It is possible to call them Eoliths of late type—an intermediate position suggested by a large number bearing evidence of extreme climatic conditions in their rubbed and striated surfaces. Without placing too much reliance on the occurrence of these scratches, it may well be argued that the large proportion of implements so marked will agree with their suggested interglacial age. The implements, as you will see, are but slightly rolled, the points and edges being comparatively fresh. Their *flat* surfaces, however, are abundantly striated, and in one instance, whilst the sinuous edge remains perfectly fresh, the flat surfaces are not only much scratched, but literally ground away. The fact therefore that these portions of the implements usually attacked in running water remain unaltered, whilst the flat surfaces bear evidence of rough treatment seems to call for some less mobile transporting agent than running water. I do not for one moment suggest that we have here evidence of ice action in its Continental sense, but that these implements received their scratches owing to their transport on masses of frozen material floating down stream, accumulating on flood plains and grinding each other in the processes of accumulation and dispersal. It may perhaps be well to examine the conditions under which these striated flints occur; the diagram at Fig. 1 shows the patch of gravel in which they occur situated between 450 and 470 feet O.D. A careful examination of its composition shows a remarkable collection of materials. It may be tabulated thus:—

1. Green-coated flints from base of Thanet Sand.
2. Fragments of ironstone.
3. Scratched flints, already alluded to (worked and unworked).
4. Palæolithic flakes and implements, quite unrolled.
5. Neolithic flakes in great abundance.
6. Large unrolled flints from the chalk.
7. Chert.
8. Quartzite.
9. Oldbury stone (red variety).

The greater number of the constituents above mentioned are of southern origin, and may therefore be regarded as a southern drift, brought down by the Darent when that river ran some 300 feet above its present level. That the material is later than the

Well Hill Eolithic gravel is well shown by its varied composition, and also to a lesser extent by the finer work exhibited on the implements. At all events, the scratched flints are so



FIG. 5.—LATE PALÆOLITHIC IMPLEMENT, COCKERHURST FARM,
WELL HILL, 450 FT. O.D.

closely associated with the upper bends of the Darent Valley that little doubt can be entertained as to the origin of the deposit.

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The Photographic and Pictorial Survey and Record of Essex has been inaugurated by the Essex Field Club for the purpose of gathering a permanent collection of photographs and other pictures of objects of interest, also maps, plans, and other documents, so as to give a comprehensive survey and record of all that is valuable and representative of the County of Essex, and of the neighbouring rivers and sea.

The preliminary arrangements having been completed, the Council are prepared to receive contributions to the funds of the Survey, and also photographs, prints, etc., for the permanent collection.

The Hon. Secretary will be glad to correspond with Societies of kindred nature, Archæological Societies and Photographic Societies, and with anyone willing to assist in the work of the Survey.

RULES.

(1.) This Society shall be called 'THE PHOTOGRAPHIC AND PICTORIAL SURVEY AND RECORD OF ESSEX,' and shall be a Committee of the Council of the Essex Field Club, and shall consist of the Officers of the Essex Field Club, the Curator of the Essex Museum (*ex-officio*) and an Honorary Secretary, with the addition of (subject to their acceptance) the Chairman of the Education Committee of the County Borough of West Ham, the Principal of the Technical Institute, the Secretary of the Essex Archæological Society; and such co-opted members as may be nominated by the Council of the Survey.

(2.) All those persons referred to in Rule 1 shall be denominated the Council of the Survey, hereinafter referred to as 'the Council,' whose Executive Officers shall consist of a President, Vice-Presidents, an Hon. Treasurer, an Hon. Secretary, and the Curator of the Essex Museum (*ex-officio*). The President of the Essex Field Club for the time being shall be the President of this Council.

(3.) The objects of the Society shall be:—

- (a) To obtain and to preserve, by permanent photographic process, drawing, painting or engraving, records of antiquities, anthropology, buildings of interest, geology, natural history, passing events of local or historical importance, portraits, scenery, maps, plans and documents, so as to give a comprehensive survey of all that is valuable and representative of the County of Essex, and of the neighbouring rivers and sea. Lantern slides of a like nature shall also be admissible.
- (b) To promote intercourse with kindred societies, Archæological Societies and Photographic Societies, and to exchange prints therewith.
- (c) To arrange where possible for the photographing of any objects not generally accessible.

(4.) The photographs, pictures, engravings, plans, etc., as defined by Rule 3, collected by the agency of the Council, shall be deposited in the Essex Museum of Natural History (the Passmore Edwards Museum) in accordance with the Agreement between the Corporation of West Ham and the Essex Field Club for the management of the Museum, and with rule 9. Duplicates may be exchanged or deposited with any other Museum, Library, or other depository, at the discretion of the Council.

(5.) That a special Committee of Selection and Advice shall consist of the President as Chairman, the Hon. Treasurer, the Principal of the Technical Institute, the Curator of the Essex

Museum, the Hon. Secretary, and five other members of the Council, all of whom shall be elected annually, and shall be eligible for re-election by the Council. The present Committee shall consist of:—

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Mr. Victor Taylor (Hon. Secretary).	

(6.) Prints must be made by Carbon, Platinum, or other permanent process, and be forwarded unmounted to the Essex Museum, accompanied by full particulars.

Whole plate ($8\frac{1}{2} \times 6\frac{1}{2}$) and half plate ($6\frac{1}{2} \times 4\frac{1}{2}$) shall be the standard sizes for prints, but prints or negatives of a smaller size may be accepted. They should be sent to the Hon. Secretary of the Survey at the Museum, and, when approved by the Committee of Selection, will be mounted and labelled, and deposited in the permanent collection. Engravings, paintings, sketches, maps, plans, and documents are also solicited.

(7.) The copyright of a photograph shall remain the property of the owner of the negative, unless otherwise agreed.

(8.) The Society shall consist of members contributing not less than 2s. 6d. per annum; subscribers of not less than 10s. 6d. per annum shall be eligible for election as Vice-Presidents. These contributions, and any other subscriptions or donations, shall be carried to a fund for Secretarial and other expenses. New Members shall be admitted by the Council at their discretion, on the proposal of at least one Member.

(9.) The expenses of mounting, arranging, cataloguing, and generally of conserving the photographs and other objects will be defrayed by the Museum, and by any outside contributions available after payment of expenses referred to in Rule 8.

(10.) The Council shall meet in June and December; the Meetings of the special Committee of Selection and Advice shall be held not less than four times a year; or when called by the Secretary. At Meetings of the Council five shall form a quorum; and in the case of the Committee of Selection, three shall form a quorum.

(11.) An Annual Meeting of the Members of the Society shall be held in some convenient place in Essex or in London, at which a report of the work done shall be given, and the assistance of the donors and workers acknowledged. If possible, an Exhibition of the photographs and other objects shall be held at least once a year.

(12.) The public shall be permitted to inspect the collections under such rules and regulations as may be drawn up by the Council and by the Curator of the Museum, subject to the rules laid down for the opening of the Museum.

(13.) Subscriptions shall be due and payable on 1st January in each year, and upon admission as a Member.

(14.) Alterations of these rules shall be made only at an Annual Meeting or Special General Meeting.

(15.) The Committee may make and alter such By-laws and Regulations not inconsistent with the rules, as they from time to time shall think necessary.

BY-LAWS.

Conditions as to the Acceptance of Photographs, &c.

(1.) Prints should be made by Carbon, Platinotype, or other permanent process, and forwarded unmounted to the Hon. Secretary at the Essex Museum.

(2.) Such prints must be accompanied by descriptive Schedules, giving information as to the object photographed, the date on which the negative was taken, the process used for printing, and the name and address of the photographer. These Schedules may be obtained from the Hon. Secretary on application.

(3.) Although whole plate ($8\frac{1}{2}$ by $6\frac{1}{2}$) and half plate ($6\frac{1}{2}$ by $4\frac{3}{4}$) are the standard sizes for prints, smaller prints may be sent in for inspection, and will, if approved, be retained. Hand camera negatives may be accepted if suitable for enlargement.

(4.) Suitable engravings, sketches, paintings, maps, plans and documents are also solicited.

(5.) In sending unmounted photographs, prints, or drawings, care should be taken to protect them by enclosure between very stout pieces of cardboard, cut slightly larger than the print and perfectly flat; or in rigid cardboard cylinders.

(6.) When making negatives, some object, the length or height of which (as specified in the Schedule) will show proportionate scale, should be included in the photograph.

(7.) Enlargements from negatives lent shall remain the property of the Society. Reasonable care will be exercised, but the Society will not be responsible for any damage to the negatives.

(8.) Members and others who are willing to undertake the survey and record of their own or special districts should communicate with the Hon. Secretary, as it is desirable to avoid unnecessary duplication in the work of the Survey.

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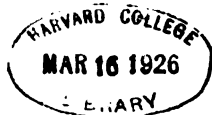
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ESSEX NATURAL HISTORY MUSEUM, STRATFORD ESSEX.



THE CORRESPONDING SOCIETIES' COMMITTEE OF THE BRITISH ASSOCIATION.

CAMBRIDGE, 1904.

REPORT OF THE CLUB'S DELEGATE,

F. W. RUDLER, I.S.O., F.G.S., President E.F.C., Secretary of the Conference
of Delegates.

[*Read November 26th, 1904.*]

UNDER the presidency of the distinguished physicist, Principal E. H. Griffiths, F.R.S., of the University College of South Wales, the delegates held two meetings at Cambridge on the 18th and 23rd of August. A discussion of rather animated character, initiated by the Chairman's address, shewed that many of the delegates entertained the opinion that a much closer union should be established between the Association and the affiliated societies. The Chairman proposed that a "Journal of Corresponding Societies" should be started, and that this should be supported by levying a contribution from the affiliated societies at the rate of 5s. per annum for every 50 members. This works out at scarcely more than a penny a year for each member. If the Essex Field Club has on its roll 300 subscribing members, an annual contribution of 30s. would be payable. The Journal would be, at any rate at first, a very unambitious publication—a mere record of meetings, with titles only of papers, and with official notices from any society which might desire to call attention to work requiring co-operation, or to any points on which information was desired. By means of this organ all the societies could unite in common action for any purpose considered to be of national or scientific importance. The committal of the British Association to the publication of such a periodical is a grave step, which will need serious consideration by the Corresponding Societies' Committee and by the Council of the Association. Several delegates have pointed out that the societies which they represent could ill afford, in their financial struggle, to subscribe to such a journal in the way suggested.

At present no society can be affiliated to the British Association unless it publish papers recording some kind of original observation. Principal Griffiths suggested that this condition might well be relaxed in favour of certain smaller

societies. These should be admitted with slightly restricted privileges under the title of "associated societies," whilst the publishing bodies, with full rights, would be called "affiliated societies."

Mr. Whitaker, the Chairman of the Corresponding Societies' Committee, speaking in favour of a revision of the conditions of union, expressed his opinion that the support of a well-organised museum was probably a work of more importance than the publication of transactions, and should accordingly be recognised. The Rev. T. R. R. Stebbing held that publication was not the most essential function of a local society; if a paper were worth printing as an original communication, it ought to appear in the journal of some central society, whereas if it were not worth printing its publication was not a gain to science. The Rev. G. B. Stallworthy suggested that an official inspector appointed by the Association should periodically visit the various societies in union, and report to head-quarters as to the character of the work which they were carrying on.

Considering the relation of the Essex Field Club to two museums, it should be of interest to our members to notice a paper read to the delegates by the Rev. W. Johnson, of York, "On the utilization of local museums with special reference to schools." The author held that local museums usually fail by giving undue prominence to what is rare or special, whereas a beginner wants to see the common natural objects, in order that he may identify them in his field excursions. In order to attract a young student it is necessary that a detailed description of a given specimen, with drawings of its separate parts, should be placed by side of the exhibit. With the view of inculcating a taste for museums, Mr. Johnson strongly advocated the practice of taking school children to Museums where the specimens were not bewilderingly numerous and where each object was intelligibly described. Demonstrations should be given either by teachers or by curators—preferably the latter; and warm appreciation was expressed of the work of Mr. Crowther, the Curator of the Leeds Museum. Mr. Johnson urged upon the museum authorities the necessity of providing in connection with the museum a room for such demonstrations, equipped with lantern, screen, and all other necessary appliances. For the labour involved in demonstration he considered that the

State might reasonably be called upon to pay. Local authorities should be empowered to hand over to the trustees of the local museum an adequate sum for this assistance to higher science teaching¹.

At the second meeting, Mr. John Hopkinson, of the Hertfordshire Field Club, brought forward some practical suggestions as to certain matters of bibliographical interest in connection with the publications of local societies. He urged the necessity of printing the date of publication of a number, not merely on the cover, but also in the body of the journal, so that the date at which any given paper was issued might always be determined, and questions of priority of publication be settled. The wrappers of the several parts should be bound in the volume; for, if not preserved in this way, the date of issue, when only on the cover, is lost. He naturally condemned the practice of publishing a volume without index or table of contents, or list of illustrations. In printing the name of the author of a paper, initials, if not the full Christian name, should always be given for sake of clear bibliographical reference. With regard to the important matter of reprints, Mr. Hopkinson urged the necessity of always giving the number of the volume from which the paper is extracted, the date and the original pagination. The type should never be shifted, and the pagination of the separate copy should be preserved in exact correspondence with the original.

Dr. Tempest Anderson, of York, the vice-chairman of the conference, advocated uniformity in the size and shape of the publications of local societies. The *format* which he recommended was about that of the *Century Magazine*. This is rather larger than the *ESSEX NATURALIST*. The matter of size, however, was carefully discussed some years ago by a Committee of the British Association, and the size then officially recommended was demy octavo, which is that of our own publication. It was suggested, however, in the discussion that the time had come for a revision of this question, and Dr. Anderson explained that the extended use of photography rendered a rather large page necessary in order to introduce effective illustrations.

With regard to the work of the various sections of the British Association which might be aided by the corresponding societies, it will suffice to refer only to what immediately concerns the

¹ Mr. Johnson's paper has been published in the *School World* for October, 1904.

Essex Field Club. A joint committee of the Geological and Geographical Sections has been appointed for the purpose of ascertaining and recording the exact significance and derivation of local terms applied to topographical and geological subjects. Any member of this Club who can throw light upon such words as are used in East Anglia, especially in Essex, should communicate their information to the Secretary of the Committee at the British Association offices.

In biological work several subjects had been suggested at former meetings without producing any substantial result. Such, for instance, were (1) cave faunas, (2) the zoological changes on a given plot of land during the year, (3) the compilation of local faunas, for which a complete working scheme has been prepared, and (4) systematic observations on the micro-organisms of a given pond or ditch. In addition to these the following new subjects for investigation are now recommended, namely, (5) the overland lines of migrations of birds, and (6) the collection of British slugs.

Miss Ethel Sargent, of Reigate, still appeals for information as to British orchids, especially as to the length of time the leaves are above ground, and as to their reproduction by means of seeds.²

Reviewing the work of the Cambridge Congress, as a whole, it seems likely that the discussions at the meeting will give a fresh impetus to the efforts of the Corresponding Societies' Committee and lead to a strengthening of the union between the societies and the Association.

ABSENCE OF THE BEECH IN HAINHAULT, AS CONTRASTED WITH EPPING, FOREST.

By W. H. DALTON, F.G.S.

MR. Buxton's remarks on this topic at the meeting of June 4th suggested investigation of the differences underlying the general resemblance of the two areas. In both, the mass of the hills consists of London Clay, both have a scanty remnant of Bagshot Beds on the crest of the main ridge, the highest points being occupied by Glacial boulder-clay, gravel, and loam, whilst the lower ground is sprinkled with patches of gravel of undefined age, probably in some cases the

² Rep. Brit. Assoc. for 1903 (Southport), p. 493.

residua of deposits formerly occupying a higher level than their present situation, and let down by the valley-ward flow of the clay on which they rest, a progress too molecular to be termed landslip, and too deep-seated to come under the denomination of soil-creep. Landslips consist in the descent of one or more continuous masses, gliding down more or less regular internal planes of disconnection, as distinct from outward falls of cliff or escarpment. Soil-creep, on the other hand, is chiefly, though not wholly, due to alternations of frost and thaw, whilst the descent of sheets of gravel and sand, without disturbance of the bedding-planes, by lateral flow of the subjacent clay under their weight, is the result of simple saturation, which frost would rather hinder than help. It is, however, doubtful if in this country the influence of frost ever penetrates deep enough to affect the process in question.

Detailed study of the environment of the beech groves elicits the general rule that patches of gravel, of but few feet in thickness, and resting on so gentle a slope of clay as to be almost continuously water-logged, constitute the favourite habitat of the beech. Bagshot or Westleton pebble-beds, or Glacial (or more recent ?) gravels, seem to be indifferently selected, the hydrological conditions being the main factors in the great question, "To be, or not to be," for *Fagus sylvatica*.

The chemical elements present in the soil, or in the percolating waters, may have a minor influence on the ultimate development of the trees, a neutral or alkaline condition being indicated as favourable, acidity as hostile. The Chalk supports many noble beech-forests, and the ashes of the timber contain a large preponderance of lime over other bases, whilst sulphates and chlorides occur only in very limited proportions. In Hainault there is a much less quantity of gravel, and the fine sand of the Bagshot Beds, as mentioned in a previous note (p. 245), is more or less charged with sulphuric acid from decomposing pyrites. Probably these considerations are not the sole causes of the difference between Epping and Hainault in respect of beech-trees, but in the complex relations which affect the existence of every form of life some factors are of paramount, others of minor or no importance in each case, and I venture to think that those I have indicated are amongst the foremost for the subject of his note.

THE RE-DISCOVERY OF *LIMAX TENELLUS*, MULL., IN BRITAIN AND ESSEX.

By T. PETCH, B.A., B.Sc.

ALTHOUGH the first British example of this species was discovered in Durham in 1853, and its occurrence placed beyond question by an accurate coloured drawing by Mr. F. Alder, the absence of other authentic records during the last fifty years threw considerable doubt on its status as a British species and finally led to its exclusion from the list of British mollusca.

This year, the Rev. Robert Godfrey, whilst collecting slugs for Mr. W. Denison Roebuck, found it in abundance in the pine woods of Rothiemurchus, vice-county Easternness (*Naturalist*, Oct. 1904), and, what may be more interesting to Essex naturalists. Mr. C. T. M. Plowright and myself found several specimens in Epping Forest, near Loughton, on Oct. 2nd.

Limax tenellus resembles *L. cinereoniger* in its preference for fungi. It is said to pass half the year underground, living on fungal hyphæ, appearing above ground with the fungi in autumn. In the present instance it was taken on *Russula vesca* in company with *Arion hortensis*. In Germany it is almost exclusively a pine-wood species, inhabiting, as at Rothiemurchus, the accumulations of pine needles in the deeper parts of the forests. In Epping it was found under pollarded hornbeams in a somewhat open situation, where the ground was well grassed over, a habitat for which it has been recorded from Russia and Scandinavia.

Owing to its moderate size (30-40 mm.) and slender, delicate appearance, this slug may easily be passed over as an immature example of one of the larger species, but the black tentacles, uniform yellow colouring, and yellow slime separate it from all others. All the British examples are referable to the variety *cerea*, in which the animal is "of a somewhat uniform waxy-yellow colour, with only faint traces of lateral banding."

Mr. J. W. Taylor, to whom an Epping specimen has been submitted, writes: "It is an undoubted example of *Limax tenellus* var. *cerea*."

ESSEX WORTHIES, IV.

GEORGE EDWARDS, THE STRATFORD NATURALIST.

By JOHN AVERY.

[Read February 22nd, 1902.]

WITH PLATE XIII.

GEORGE EDWARDS, the son of George and Mary Edwards, was born at Stratford, in Essex, and baptised in West Ham Church on 7th of April, 1693. He passed some of his early years under the tuition of a clergyman named Hewitt, who was then master of a public school at Leytonstone.

After leaving the school he was placed with another clergyman of the Established Church at Brentwood, and being designed by his parents for business, was apprenticed to a tradesman in Fenchurch Street, London. His master, who was strictly religious and distinguished for classical scholarship, treated him with remarkable kindness and consideration. About the middle of the term of his apprenticeship there occurred the death of a certain Dr. Nicholas, an eminent savant related to Edwards' master. The doctor's extensive library was removed from Covent Garden to the apartments of the young naturalist, who availed himself fully of this unique opportunity, and passed all the leisure of the day and, not unfrequently, a considerable part of the night in turning over this collection of works on natural history, fine arts, and antiquities.

The path to wealth through commerce ceased to attract him the shop and the exchange had lost all their delights; and, on the expiration of the term of his indentures, he determined to travel abroad to improve his taste and enlarge his mind.

In 1716, having no intention of entering business, he visited most of the principal towns in Holland, being absent about a month. On his return he remained two years in London and its neighbourhood, and then sailed for Norway, at the invitation of a gentleman who was disposed to be his friend, and whose nephew was master of the vessel in which he embarked.

Nothing material occurred on the voyage, and they soon arrived at the destined port.

A country diversified with rocks of stupendous magnitude, and trees of unfading verdure, where some of the natives had scarce experienced the arts of civilisation, could not fail to afford novelty, if it did not impart satisfaction to an Englishman. The

summer nights were short ; and few hours were allotted to sleep, either by Edwards or his company. Sometimes they wandered on the banks of creeks, the haunt of sea fowl, and other wild birds, where no articulate voice was heard, and, on other occasions were lost in wonder at the luxuriant and unfamiliar vegetation of the hills.

They remarked, too, the inhabitants content with their comparatively barren country and lack of desire to leave their snow-clad mountains for the fertile and genial south, and they frequently experienced among these illiterate people that genuine hospitality which flourished less vigorously in more civilised countries.

In this excursion Edwards was not distant from the thunder of Charles XII.'s cannon, who at that time besieged Friednch-stardt ; where that unfortunate monarch stained his laurels by an ignominious defeat, and was deprived of his life as well as his crown.

Edwards was prevented from visiting Sweden by this circumstance, as the Army was in the habit of summarily arresting all strangers, and those who could not give a good account of themselves when they happened to meet with them. But, notwithstanding his precaution, he was captured by the Danish Guard, who erroneously suspected him of being a spy employed by the enemy to obtain intelligence of their designs. However, by procuring evidence of his identity a release was granted.

In July he embarked for England, but the ship on its arrival at Scilly was detained by contrary winds. During his detention here, his leisure time was chiefly taken up with fishing and such other amusements as his situation would admit, and he was not a little delighted with the vast cliffs of that romantic island and the harsh cries of its feathered inhabitants.

Upon his arrival in London he retired to West Ham, where he spent the winter ; but, being desirous of visiting France, in 1719 he journeyed by way of Dieppe to Paris, and, having seen its objects of interest, took a lodging in a village called Greencourt, in the great park of Versailles ; but, to his disappointment, the managerie, at that time, had no living creature in it.

In consequence of the King's minority the Court was not residing at the palace, and the famous collection of animals, &c., had been neglected, and either died or become dispersed.

He was, however, deeply interested in the sculpture and paintings in the public buildings and in the relics exhibited in the churches and religious houses.

During his stay in France he journeyed first to Chalons in Champagne, in May, 1720; and on foot to Orleans and Blois, in disguise with a view to escape the beggars who often assaulted travellers. He did not know, however, that an edict had just been issued for the arrest of vagrants, in order to transport them to America, as the banks of the Mississippi wanted population, and Mr. Edwards narrowly escaped a western voyage.

On his return to England he closely pursued his favourite study, applying himself to drawing and colouring such subjects of natural history as came under his notice.

He gave strict attention in the first instance to natural, rather than picturesque beauty, devoting himself more particularly to the study of birds, and having purchased some of the best pictures of these objects, he commenced to make a few drawings of his own, which were admired by his supporters, who encouraged the young naturalist to proceed, by paying a good price for his early efforts.

Among his first patrons and benefactors may be mentioned James Theobalds, Esq., F.R.S., a gentleman zealous for the promotion of science. Our artist, thus unexpectedly encouraged, increased in skill and assiduity, and procured, by his application to his favourite pursuit, a decent subsistence and a large circle of acquaintances.

In company with two of his relations in 1731 he made an excursion to Holland and Brabant, where he collected several scarce books and prints, and had an opportunity of inspecting original pictures by several great masters at Antwerp, Brussels, Utrecht, and other cities.

In December, 1733, upon the recommendation of Sir Hans Sloane, Bart., President of the Royal College of Physicians, Edwards was chosen Librarian of that Institution, and had apartments allotted to him in the College. This office was peculiarly agreeable to his taste and inclination. It afforded constant access to a valuable library, filled with scarce and curious books on the subjects of Natural History, which he so diligently studied that by degrees he became one of the most eminent Ornithologists of his period.

It may be observed that he never trusted to others what he could perform himself, and found it so difficult to give satisfaction to his own mind that he frequently made three or four drawings to delineate the object in its most striking character and attitude. In his work he was greatly assisted by having resort to the collections formed by Dr. Fothergill at Upton and to those belonging to Captain Raymond at Valentines, Ilford.

The publication of the *History of Birds* began in 1743, the first volume appearing in quarto size. The number of the subscribers exceeded Edwards' most sanguine expectation, and a second volume appeared in 1747. The third volume was published in 1750, and in 1751 the fourth volume came from the press. This volume being the last he intended to publish at that time, he seems to have considered it as the most perfect of his productions in Natural History, and there devoutly offered it up to the great God of Nature, in humble gratitude for all the good things he had received.

Under the new title of *Gleanings of Natural History*, a further volume appeared in 1758. A second volume of the *Gleanings* was published in 1760, and the seventh and last volume of his works appeared in 1764.

Thus the author, after a long series of years, by means of the most studious application, and extensive correspondence to every quarter of the world, concluded a work which contains engravings and descriptions of more than six hundred subjects in Natural History, many not previously described or delineated.

A generical index in French and English was added, and was afterwards completed with the Linnean names by the great naturalist Linnaeus himself, who frequently honoured Edwards with his friendship and correspondence.

Upon finishing the work, we find the following declaration, or rather remarkable petition, of the author, where he seems afraid lest this passion for his favourite subject of Natural History should get the better of nobler pursuits, viz., the contemplation of his Maker.

“My petition to God (if petitions to God are not presumptuous) is, that he would remove from me all desire of pursuing Natural History, or any other study ; and inspire me with as much knowledge of his Divine nature as my imperfect state is capable of, that I may conduct myself, for the remainder of my days, in a manner most agreeable to his will, which must consequently be most happy to

myself. What my condition may be in futurity is known only to the Disposer of all things; yet my present desires are (perhaps vain and inconsistent with the nature of things?) that I may become an intelligent spirit, void of gross matter, bravity and levity, endowed with a voluntary motive power either to pierce infinitely into boundless ethereal space, or into solid bodies; to see and know, how the parts of the great Universe are connected with each other, and by what amazing mechanism they are put and kept in regular and perpetual motion. But oh, in vain and daring presumption of thought, I most humbly submit my future existence to the supreme will of the one Omnipotent?"

Some time after Mr. Edwards had been appointed Librarian to the Royal College of Physicians, he was, on St. Andrew's Day, in the year 1750, presented by the President and Council of the Royal Society with the Gold Medal, the decoration of Sir Godfrey Copley, Bart., annually given on that day to the Author of any new discovery in Art or Nature, in consideration of his *Natural History* just then completed. A copy of this medal he afterwards caused to be engraved and placed under the general title in the first volume of his history. He was subsequently elected a Fellow of the Royal Society, and on the 13th February, 1773, he became a Fellow of the Society of Antiquaries, and also a member of many of the learned Societies in different parts of Europe. In acknowledgment of these honorary distinctions from such learned bodies, he presented elegant coloured copies of all his works, to the Royal College of Physicians, the Royal Society, the Society of Antiquaries, the British Museum; and to the Royal Academy of Sciences at Paris, from which he received the most cordial and complimentary letter of thanks by their then Secretary, Monsieur Defouchy.

Several occasional papers upon natural history were communicated by Mr. Edwards to the Royal Society and inserted in the *Philosophical Transactions*. They will be found in the 48th, 49th, 50th, 51st, 53rd, 55th, and 56th volumes of that valuable collection, and most of them have since been added with new engravings to the memoirs of his life, and to his writings. In a few instances he contributed to other periodical publications. The prefaces and introductions to many of his volumes contained some interesting and ingenious essays relative to the object of his principal pursuit. He also gave a brief and general idea of drawing and painting in water colour, with instructions for etching on copper plates. In 1770 these miscellaneous papers were collected and published in one octavo volume, the object

being to assist those students in their research who were not equal to the expense of his great work.

The nobility and gentry frequently honoured Edwards with their friendship and generous support, and he mentions with peculiar pleasure the fact that he was patronised by four great men who were, perhaps, the foremost promoters of learning, science and arts, of any during the 18th century. These were the Duke of Richmond, Sir Hans Sloane, Dr. Mead, and Martin Folkes. He was also a great friend of William Bowyer, of Leytonstone, the printer to the Society of Antiquaries.

His collection of drawings, which amounted to upwards of nine hundred, was purchased by the Earl of Bute. It contained a great number of English and foreign birds and animals, not accurately delineated or described previously.

After the publication of the last work, his sight began to fail, and his hand lost its former steadiness. Being now in his 70th year, he retired from public employment to a little house which he had purchased at Plaistow; previous to which he disposed of all the copies, as well as plates, of his works, to James Robson, a bookseller in New Bond Street.

The conversation of a few select friends and the perusal of books were the amusement of the evening of his life; occasionally varied by an excursion to some of the principal cities in England.

Mr. Edwards was of a middle stature, rather inclined to corpulence. He was of a liberal disposition and a cheerful address. All his acquaintances experienced his benevolent temper, and his poor neighbours frequently partook of his bounty.

His diffidence and humility were always apparent, and to persons who had a taste for studies congenial to his own he was a most entertaining as well as communicative companion.

A portrait by Dandridge was engraved by J. S. Millar in 1754, this was considered a most striking likeness. Dandridge was the son of a house painter.

Some years before his death the alarming ravages of a cancer in the face, which baffled all the efforts of medical skill deprived him of the sight of one of his eyes; he also suffered much from the stone, a complaint to which at different periods of life he had been subject. Yet it has been remarked that in

the severest paroxysms of misery he was scarcely known to utter a single complaint.

He died on the 23rd July, 1773, deservedly lamented by a numerous circle of friends. He left two sisters, Ann Edwards and Mary Tracey, to whom he bequeathed annuities of £60 and £30 respectively for life.

The sisters died within a few hours of each other two years after his death and were buried together in West Ham churchyard on 23rd November, 1775, thereupon his estate, which consisted of £3,000 Three per Cent. Stock, in addition to property in West Ham, passed to the children of his late half-brother, James Frost, of Maldon.

His remains were interred on July 30th, 1773, in the south-east part of West Ham churchyard, where an upright stone was erected with the following inscription, to perpetuate the memory of his talents and skill:—

Here lies interred
The Body of GEO. EDWARDS, ESQ., F.R.S.
Who departed this life the 23rd Day of July, 1773.
Aged 81 Years;
Formerly Librarian,
To the Royal College of Physicians,
In which Capacity,
As well as in private life,
He was universally
And deservedly esteemed,
His Natural History of Birds
Will remain
A lasting Monument of his knowledge
And ingenuity.

The stone has long since disappeared, and no mark now denotes the spot where our local celebrity is buried.

His will was dated the 5th May, 1770, to which a codicil was added in 1772, and these were duly proved on the 6th August, 1773, by his eldest sister Ann Edwards, who was appointed sole executrix.

In the following year his library was sold by James Robson, of New Bond Street.

Mr. Edwards left an edition of Willoughby's *Ornithology* with manuscript notes and many interesting observations in which he corrected the mistakes and supplied the omissions of former writers. It is said that they were intended to be issued to the public, but do not appear to have been published.

THE ESSEX FIELD CLUB.—REPORTS OF MEETINGS.

VISIT TO THE WALTHAMSTOW RESERVOIRS OF THE EAST LONDON WATERWORKS COMPANY.

Saturday, May 14th, 1904.

A meeting at the Reservoirs was projected last year, but was deferred owing to bad weather (*ante*, p. 247). On the present occasion Col. Bryan, M. Inst. C.E., the Engineer to the Company, kindly made all arrangements for the comfort of the party, use of a boat on the Reservoirs, and use of the large workshops for tea, etc.

The meeting was "conducted" by Mr. D. J. Scourfield, F.R.M.S., and by some other expert members of the Club. The numerous company assembled at the open spaces near the reservoirs near the Superintendent's house at Black-horse Lane. Here tables, jars, nets, &c., were arranged under a clump of trees. Numerous interesting aquatic forms of life were obtained, and exhibited in extemporised aquaria and under microscopes. A good representative series of spring flowers growing on the banks of the streams and reservoirs was shown. Mr. Scourfield and others gave many "lecturettes" on the objects—both before and after tea—and explained the use of the special nets used in investigating the entomostracous fauna of fresh-water lakes, &c. A full report of the organisms observed will probably be published later in connection with a future meeting at the reservoirs.

The President, Mr. Rudler, presided at the tea, and hearty votes of thanks were passed to Col. Bryan, the Superintendent, Mr. Jeffrey, and to the Conductor, Mr. Scourfield. The latter summed up the afternoon's work in a very interesting speech.

After tea the collecting was continued, the pleasant weather rendering the water trips and botanical rambles very enjoyable.

MEETING AT SAFFRON WALDEN, THAXTED, HORHAM HALL, AND DISTRICT.

Whitsun-Monday, May 23rd, 1904.

This meeting was arranged to take advantage of the kind invitation of our member, Mr. L. Cranmer-Pyng, to visit him at Horham Hall, Thaxted.

The main party assembled at Saffron Walden, about 10 o'clock, at the official inn, the "Rose and Crown," where some members had lodged—other visitors came by road from Dunmow and Chelmsford, and joined *en route*.

The drive from Walden was very pleasant, the county being in the prime of spring beauty. A deviation from the main road was made to allow of a visit to Debden Church, a very ancient building of brick and stone, and situated in a most delightful piece of country. The Rector (the Rev. F. H. Fisher) very kindly conducted the party over the church, and Mr. I. Chalkley Gould also assisted in the demonstration. After thanking the Rector, the drive was continued to Thaxted, perhaps the most old-world town in Essex. It was once an important centre and corporate town, but the Mayor and Corporation were suppressed by James II. The old Guild or Moot Hall still stands as a memorial of

past greatness. The "great glory of Thaxted is its church, a splendid structure, which well deserves the description applied to it of 'the cathedral of Essex,' there being (if we except Waltham Abbey Church) no other of equal magnificence in the county." The Vicar (the Rev. L. S. Westall), Mr. F. Chancellor, and Mr. Miller Christy acted as guides here, and a very considerable time was occupied in the church, and in viewing the many quaint timbered and plastered houses in the town. Samuel Purchas, author of the celebrated book of Pilgrimages, was born at Thaxted in 1577.

Carriages and cycles were resumed to reach Horham Hall, situate in the parish, where the now large party was most kindly received by our kind host and hostess, Mr. and Mrs. Cranmer-Byng. The hall, to quote again from Mr. Christy "though much modernised and reduced, is still a remarkably fine example of the style of residence which came in when the grim feudal castle went out of fashion. It is of brick, and the whole forms a venerable and picturesque pile of gables, turrets, battlemented parapets, ornamental chimneys and bay windows. The entrance-hall is still just as it was built; the remains of a gate-house may be traced, and part of the old Moat still remains. It was built by Sir John Cutte, who died in 1520, and was for long after famed for its splendour and hospitality. Queen Elizabeth, before her accession, resided here for a time, and in 1571, when on a tour through the county, was entertained by its owner."

Luncheon was served in the ancient hall, and Mr. Cranmer-Byng, as chairman, gave a most entertaining account of the house, and the memories and traditions attaching to it. Afterwards Mr. Chancellor read a paper on its archaeological and architectural history, followed by Mr. Miller Christy and Mr. Gould. This paper and discussion must be reserved for the present.

The afternoon was most pleasantly spent in the grounds, under our hosts' genial guidance. The country about the hall appears to be delightful, and likely to be of the greatest interest to the naturalist.

Bidding farewell to our kind friends, the return journey was taken by way of Elsenham, where a section of the party stayed for tea and to catch the return train. Others continued the drive back to Saffron Walden, and after tea at the inn spent the remainder of the evening in exploring the town and visiting the Museum.

[The Editor regrets that his slight acquaintance with the district and the want of space compel but a very meagre and unsatisfactory account of a most pleasant and instructive holiday. It is to be hoped that another meeting in the beautiful Thaxted country may be held in the near future, and that this may afford opportunities for descriptive accounts from some of our members having special knowledge of the district—and there are many with such qualifications.]

INSPECTION OF HAINHAULT AND LAMBOURNE FOREST.

Saturday, June 4th, 1904.

This was the third official visit of the Club to the newly-recovered lands of old Hainhaunt Forest, and it was held again under the direction of Mr. E. N. Buxton and by the kind permission of the Parks and Open Spaces Committee of the London County Council.

The two previous meetings on June 14th, 1902, and June 6th, 1903, were fully reported in the present volume of the *ESSEX NATURALIST* (*vol.* pp. 30—32,

and pp. 245—247). The details of the scheme of re-afforestation were also explained in a paper, "A New Forest of Waltham," in the same volume, *ante* pp. 25—29.

At the former meetings some elements of uncertainty existed concerning the acquisition of the lands, but on the present occasion this had passed away, and the visitors rambled through the Forest filled with the inspiring thought that they were traversing the grandest addition to our open spaces since the rescue of the Epping woodlands.

Quite a large number of members and friends attended the meeting, reaching the ground from the new Grange Hill Station, and assembling at the entrance to the Recreation Ground at Chigwell Row, this ground being a portion of the old forest. In the pond here the botanists were astonished to find abundance of an American aquatic plant, *Asolla*, floating in the water (see report of meeting on November 26th). Whilst traversing this ground one could not but be struck with the abundance of the dwarf furze (*Ulex nanus*), which is by no means a common plant in the Epping Forest district.

At a point on the road leading to Romford, about 300 yards below Chigwell Church, the party entered the gate to the woodland known as "Ethelstone's Forest," and here Mr. Buxton took the conductorship. The ramble covered the whole extent of Lambourne Forest, making for Cabin Hill, and then across the newly recovered land of Foxborough's Farm, now being replanted under Mr. Buxton's advice and superintendence. In the woods the most noticeable plants were the handsome Wood-Spurge (*Euphorbia amygdaloides*) and the edible "Earth-nut," *Conopodium denudatum* (= *Bunium flexuosum*, With.) which were in great plenty in many places.

At the replanted grounds Mr. Buxton gave some informal demonstrations, and we were favoured with the company of Prof. W. R. Fisher, of Cooper's Hill, one of the great authorities on Forestry, and of Mr. J. Groves, F.L.S., the well-known British botanist. The following observations are compiled from Mr. Buxton's and Prof. Fisher's notes :—

The London County Council is in possession of the forestal part of the Hainbault lands, including that portion lying within Chigwell parish, now for the first time thrown open to the public. Foxburrows Farm and Colonel Lockwood's arable land, comprising about 550 acres, hitherto under the plough, will not be ready for public use for at least a year. The London County Council have entrusted to Mr. Buxton the task of laying down this arable land in grass, and planting or sowing portions to produce thickets. About 400 acres have already been sown with grass, which in most cases is doing exceedingly well. From 60 to 70 acres, comprised in about twenty-five patches of various sizes, have been sown with forest seeds or planted with oak, hornbeam, birch, holly, maple, ash, whitethorn, blackthorn, bramble, dog-rose, brake-fern, broom, gorse and crab. These patches, which are naturally disposed on the slopes of the higher ground, appear to be making good progress. It will be noticed that nothing is admitted but trees or bushes indigenous to the forest.

Mr. Buxton explained that his aim was not to reproduce a wood all over this land, but rather an upland down with scattered thickets on it, as is the case with so many commons in the home counties. It is hoped that these thickets, which are at present necessarily protected, may ultimately be thrown open.

In his observations, Professor Fisher was of opinion that there would not be much difficulty with wooded portions of the area. They consist of dense masses

of thorns and briars, with hornbeam scrub, and oak and ash saplings are springing up everywhere among the thorns and hornbeams, and will in time form fine trees, especially if heavy thinnings are avoided. On the cleared land grass seed had been sown, and the grass was rapidly covering the ground. Some areas in this grassland have been fenced in and sown or planted with groups of the local forest trees, and as shelter is provided to them by thorns and bushes of *goræ*, tree growth will gradually assert itself.

There was, however, one point which Professor Fisher desired to bring before the notice of the management, and that was, why should they not have a small area, say twenty acres, planted with oak and beech, so as to form eventually a fine crop of tall trees, like the woods planted in Windsor Forest by the Duchess of Marlborough and in the New Forest by William III., or the Artistic Section in the Forest of Compiègne?

Professor Fisher alluded to the time and energy which Mr. E. N. Buxton had devoted to the carrying out the purposes of the London County Council, but a day would come when his distinguished services would be no longer available—and woods take a long time to grow. The Council would, therefore, be well advised in having a scheme of re-forestation work drawn up, say, for twenty years, and showing the financial arrangements which are necessary. Such a scheme, when once agreed upon, should be rigidly adhered to. At the end of the twenty years a revised scheme would be necessary, and the experience gained during the first twenty years would greatly assist the Council in its plan of creating another pleasure-ground for the enormous population under its charge.

There are some grazing rights on the forest area just acquired, and a tendency had been observed of the right holders using their position to introduce the cattle of outsiders, who have no rights on the land. These rights should certainly be properly regulated, and it would be worth while considering whether they could not be purchased outright by the Council, as the presence of cattle is fatal to young seedling trees that would otherwise spring up in the grassy glades among the scrub.

A marked difference between Hainault Forest and that of Epping lay in the absence of beech, which grows so well on the sandy hillocks above the clay land of Epping Forest.¹

Essex was the most north-westerly natural habit of the hornbeam. This small, but extremely hardy, tree formed large forests in Russia, and spread as far west as the north-east of France. It hardly extended to the west of the river Seine, as hornbeam cannot compete in height-growth with beech and oak, except in situations where the beech was kept back by severe spring frosts. These frosts were specially prevalent on cold, moist, clay-soils that were inimical to beech, but where oak will still grow, and where the hornbeam, which was a shade-bearing tree, formed an excellent underwood beneath the oak trees which generally required either beech or hornbeam nurses to produce fine timber.

Tea was served in the large barn of Foxborough Farm, and afterwards a discussion ensued under the chairmanship of Mr. Rudler, the President of the Club. On the proposal of Prof. Meldola and the President, a cordial vote of thanks was passed to Mr. Buxton for his kindness in conducting the meeting, and congratulating him on the successful termination of his long and arduous exertions in the recovery and re-forestation of so large a portion of the old forest lands.

¹ Consult Mr. Dalton's paper in the present part, *ante* p. 340.

Mr. Buxton replied, and expressed the hope that such a meeting of inspection by the Club would be an annual fixture. He also gave many details of his work, which are mainly embodied in the preceding paragraphs. Mr. Buxton alluded to the difficulties he had experienced in an endeavour to transplant seedlings from Epping Forest to Hainault. When the seedlings were taken up free from earth they mostly died, but when a small clod of their native earth was transplanted with the seedlings, they stood the process well. He was also puzzled at the absence of the beech from Hainault; much of the higher ground was superficially like some parts of Epping Forest where the beech flourished, and yet the tree was not found growing on it.

Prof. Fisher also spoke, and his special remarks on Hainault are summarised in like manner in this report. He gave some most interesting information on the history and methods of management of Continental Forest. He said that when we considered the magnificent State Forests which were still found in nearly all European countries except the British Isles, and remembered that there were enormous areas of Crown forests in Britain under the Plantagenet kings, it was sad to feel that most of these woodlands were alienated by our former sovereigns, either by gift, or by sale for inadequate supplies of ready money. The first King of England who showed the slightest wish to maintain our English woods was James I., who ordered that oak trees in the Royal forests should no longer be lopped. It had been the practice to pollard most of the trees in order to supply fodder to the deer during winter, as they browsed on the bark of the lopped branches, and when the latter were stripped of bark the wood was appropriated by the keepers. There were in Windsor Forest scarcely any oak trees more than two hundred years old that had not been pollarded.

The Forest of Dean appeared always to have been looked upon as a source of supply of oak for our Navy, and in one of the captured ships of the Spanish Armada, an order of Philip, King of Spain, was found, directing an expedition to be sent, after the Spanish Army had landed in England, to devastate that forest in the interests of Spain. By the reign of James I. the original vast supplies of wood from the Weald were becoming exhausted, and companies were started to make glass with coal instead of with wood fuel. There were still, however, plenty of hedgerow and coppice oaks in England, mostly in private hands; and the first important oak plantations in the New Forest were made by William III., who, as a Dutchman, recognised the necessity for a permanent supply of oak for the Navy. The old Duchess of Marlborough, who was Ranger of Windsor Forest for a long period, made some oak plantations, and her trees were properly grown, mixed with beech, and were now nearly two hundred years old, and probably the finest oak trees in Britain. Similar fine oaks, grown with beech, were formerly plentiful in the Forest of Dean, but for some reason or other the use of beech as a nurse to the oak was discontinued; and when, after the Napoleonic Wars, about £300,000 was voted by Parliament for planting oaks in the Crown forests, they were planted without any help from beech, and large areas of these branchy, poor oaks, now about eighty years old, may be seen in all our existing Crown woodlands.

Continental rulers were much less wasteful with their forests, although they were quite as great hunters of the deer as our own sovereigns. To take France as an example. In 1665 Colbert, the Finance Minister of Louis XIV., saw the necessity for maintaining a supply of oakwood for the French Navy. "La

France périra faute de bois" was his saying, and a royal inspection of all the Royal and ecclesiastical forests was ordered.

All common rights in these forests were inquired into and regulated, and such as were incompatible with the maintenance of the forests were suppressed. No sheep and goats were henceforth to graze in the Royal forests, some exceptions being made as a privilege, but not as a right, in the case of sheep. Up to this time the fellings had been by selection, as at present with us in the Chiltern Hills beech forests. The best trees and those most conveniently situated for transport were felled and the worst trees left, and portions of forest which were accessible were ruined, and inaccessible parts of the forest left untouched. By a Royal decree, which followed the inspection of the forests, each working section in a forest was divided into as many felling-areas as there were years in the rotation. The rotation was fixed at 120 or 150 years in oak and beech forest, so as to give every advantage to the long-lived oaks. Fellings were to be henceforth made in succession, only one felling-area in each working section being cleared in a year, and these felling-areas were arranged as far as possible from east to west, so as to protect the standards against the strong westerly gales. In each felling-area eight, sometimes sixteen, standards were reserved per acre, to serve as mother trees for restocking the ground, and no thinnings were to be made, but the new growth on the felling-areas and the standards were left to mature until another 120-150 years had passed. Doubtless by this exclusion of thinnings much harm was done to forests where beech prevailed—the beech got the upper hand of the oak, and much smaller material died which might have been utilised. But, on the other hand, the Royal foresters could not go wherever they liked to select the finest trees for felling, but had to be content with felling the trees in the felling areas provided for each particular year. This system, known as *Tir et Aire*, preserved the French Royal forest as dense masses of woodland with a few magnificent trees, up to 1830, when the present more intelligent system was introduced. Under this system thinnings were made whenever they were required, and the State forest officers, being specially trained for the work, were no longer tempted to make extensive thinnings in order to yield a large temporary revenue, but worked the forests for a sustained yield of fine timber. Owing to the density of the French woodlands and to the necessity for finding a passage for the Royal hunts, numerous roads and rides were cut in the forests, which were pierced in all directions with a complete network of export lines.

The French ecclesiastical forests were also regulated by Colbert, and when, during the French Revolution, all these forests became the property of the State, they were found to be in splendid order, and the area of State forests was largely increased. Ecclesiastical forests were similarly confiscated throughout Germany and Austria after the French Revolution, and these, with the original Royal forests, formed the great mass of forest lands then owned by nearly all the European States. Our ecclesiastical lands, confiscated by Henry VIII., were conferred mostly on a number of greedy courtiers, and the same thing happened to the ecclesiastical lands of Scotland.

The Stuart kings did not seem to have had in Scotland any royal domain worth mention, except a few castles. In Ireland, although vast estates were confiscated by James I. and by Cromwell, they were conferred on the City of London and on Cromwell's colonels, so that there are scarcely any State lands in Ireland, and, though there were some in Wales, they are mostly heather waste,

although there was now a talk of planting up some of those Welsh State lands. From the above sketch it was easy to see why we had such a limited area of Crown woodland as compared with our neighbours.

Long before the final rescue of Epping Forest by the Corporation of London, Hainault had been completely disafforested, its oaks and other trees uprooted, and its lands converted into farms, except some small areas of hornbeam and thorn-scrub, containing a few oak and ash trees. It was said that the disafforestation of Hainault Forest was due to the initiative of the Prince Consort, who found in its rich clay lands the only site in the Crown property suitable for the establishment of farms on the German method of agriculture, in which he was interested. There could be little doubt that our Crown forests still remaining owed their maintenance largely to the fact that they were chiefly situated on lands too poor for agriculture, or too poor to have been coveted by courtiers. The prosperity of these Crown farms resulting from the uprooting of the fine old oak trees had been of short duration. The revenue of £4,000 a year, from which so much was hoped, soon fell with the price of wheat, and the £40,000 from the sale of the oak trees in 1852 would have probably accumulated to at least £100,000 by this time had the oaks been allowed to stand. The heavy London clay, which had produced fine oaks, soon ceased to be valuable for wheat growing, and now by the liberality of private persons, assisted by the London County Council, some of the land had been re-acquired for the public, and was under public control.

All must rejoice that Mr. E. N. Buxton, who had done so much for other open spaces, was also the prime mover in the rescue and reafforestation of Hainault Forest.

Prof. Fisher was greatly applauded for his interesting address, and the meeting broke up. The party spent some time in examining the replanted lands, and then walked back to the Grange Hill Station

MEETING ON THE RIVER LEA: VOYAGE FROM HERTFORD TO ENFIELD LOCK.

Wednesday, June 29th, 1904.

On four previous occasions the members had taken part in voyages on board the steam barge "Salisbury," kindly lent by the Board of the Lee Conservancy, but it was felt that days in the open so pleasant and interesting were good omens and encouragement for attempting yet another voyage on the Lea. A tone of sadness pervaded the meeting in the absence of our kind and genial friend, the late Major Lamorock Flower, who had so well organised the previous voyages. Beyond the sense of personal loss we all missed the Major's racy and enthusiastic demonstrations at the points of interest and beauty presented by his favourite stream.

It is needless to repeat the descriptions already published of the scenery and history of the Lea. All accessible information will be found in former reports in the *ESSEX NATURALIST*.¹ The party assembled at Hertford at about 11 o'clock, and soon afterwards embarked on board the "Salisbury," which had been fitted up with cabin and deck for the official visit of the Board, and Mr. Corble, the Clerk, most kindly continued all arrangements for the Club's benefit on this occasion. The voyage down the river was at once entered upon, the

¹ See report of former meeting on June 15th, 1899, in *E.N.*, vol. xi., p. 130.

weather being perfect and the river banks looking their best in their attire of early summer flowers. The scientific conductors were Prof. Boulger, F.L.S., Mr. Wilfred Mark Webb, F.L.S., and we were favoured with the presence of our President, Mr. Rudler, F.G.S., Mr. E. T. Newton, F.R.S., and Mr. J. A. Clark, F.E.S. Stoppages were made from time to time to permit of botanising on the banks and meadows. A great number of the commoner riverside plants were noticed—and the great abundance of the yellow iris (*Iris pseud-acorns*), the yellow mimulus (commonly called *Mimulus luteus*), the melilot (*Melilotus officinalis*), and of tomato plants (!) on the rubbish-heaps forced themselves upon the attention of even non-botanical visitors. A number of “nests” of the tortoiseshell butterfly (*Vanessa urticae*) were observed on the nettles by the water-side. Some of informal demonstrations on the mollusca, insects and plants were given on the deck of the barge.

Luncheon was taken at the Rye House, Hoddesdon, and afterwards an Ordinary Meeting (the 231st) was held, the President in the chair.

Mr. Alfred Buxton was elected a member.

A paper on “The Uredineæ and Ustilagineæ of Essex,” by Mr. F. J. Chittenden was read in abstract by Prof. Boulger. (This paper was printed *ante* pp. 283—294).

The Secretary read portions of a paper by Mr. F. W. Reader, entitled “Wooden Water-pipes at Clarkenwell” (*ante* pp. 272—4).

Thanks were voted for these papers, and with some announcements of future meetings, the business ended.

During the afternoon Prof. Boulger gave a very interesting address on “Aquatic Plants,” illustrated by several species obtained from the river, and Mr. Wilfred Mark Webb gave a demonstration on Aquatic Mollusca, based on examples obtained during the day.

Tea was served on board as on previous occasions, and the voyage terminated at Enfield Lock, the bulk of the members taking train home, whilst others drove by road to Woodford, Buckhurst Hill, etc.

THE ANNUAL FUNGUS FORAY.

Saturday, October 15th, 1904.

As frequently on previous occasions, the headquarters for this meeting were at the “King’s Oak” Hotel, High Beach, Epping Forest. The day was fine and dry, and the numerous parties of collectors much enjoyed the ramble in the autumnal woods. The experts on this occasion were Dr. M. C. Cooke, A.L.S., Mr. George Massee, F.L.S., Mr. Arthur Lister, F.R.S., Miss G. Lister, and Mr. A. Clarke, of the Yorkshire Naturalists’ Union, from Huddersfield.

A short excursion had been made on the previous Thursday by the Hon. Secretaries, and the specimens collected had been sent to the exhibition room, together with those collected during the early part of the day on Saturday, so that the examination and determination could be proceeded with at once. The ground in the forest was very dry, and cracking in many places, so that the crop of fungi was unusually small, and considerably reduced by the cold dry winds and recent frosty nights. Notwithstanding all the drawbacks, no fewer than 100 species were determined as the result of the foray, and amongst these were several species of special interest. Of the latter may be mentioned a young specimen, about five

inches in diameter, of *Hydnum erinaceum*, bristling all over with slender spines like a hedgehog, and which had not been seen in the forest during the last twenty years. One notable feature of this meeting was the entire absence of many species which have been seen on the tables year by year on previous occasions.

The common Hedgehog Mushroom, *Hydnum repandum*, often found plentifully in the forest, was not represented by a single specimen, neither was there a solitary example of either the common Mushroom or the Horse Mushroom. In fact, edible species, including the Chantarelle, the Shaggy Caps (*Coprinus*), the Parasol Mushroom, and many others usually seen on the tables, were almost wholly absent.

It was found, upon a close and critical examination, that about twelve species were determined, which had not been recognised before within the limits of the county, and some were evidently found in Britain for the first time. The latter are distinguished by a * in the enumeration below:—

Tricholoma guttatum (Schæffer), about half a dozen characteristic specimens.

Clitocybe tornata (Fries), only seen in this country two or three times previously.

* *Collybia tubescens* (Scopoli), for the first time.

* *Mycena discopus* (Lév.), a very minute species on dead leaves, which had previously escaped notice.

Hygrophorus penarius (Fries), only one or two specimens, easily confounded on cursory examination with *Hygrophorus eburneus*.

Cantharellus friesii (Quelet), resembling a little the common *Cantharellus aurantiacus*.

* *Entoloma plutoides* (Fr.), this species was found for the first time in Britain.

Psalliota complutus (Fries), the only representative of the true Mushroom group.

Polyporus nidulans (Fries), several fine specimens from a tree near Loughton Station.

Corticium comedens (Fries), on dead sticks common, but previously overlooked.

Thelophora fatidiosa (Fries), with a very strong and somewhat fetid odour.

Disporella monilifera (Saccardo), in great quantity on various stumps, associated with the common black mould, *Dispora moniloides*. This is a small *Peziza* or *Helotium*, of which it is now affirmed that the black mould is the conidial form, although the evidence is not quite convincing.

Dutrepe disciformis (Hoffmann), common on dead twigs, but not previously notified in the lists.

Mr. Lister reported that the following species of **Mycetozoa** had been gathered during the day:—

Patharia utricularis Berk. In sclerotium.

Physarium nutans Pers. Vars. β and α in abundance.

Semonitis fusca Roth.

„ *ferruginea* Ehrh.

„ *splendens* Rost, var. *confluens*.

Comatricha typhloides Rast.

„ *obtusata* Preuss.

Trichia affinis De Bary.

Trichia scabra Rost.

„ *varia* Pers.

„ *fallax* Pers.

„ *botrytis* Pers.

Arcyria punicea Pers.

„ *incarnata* Pers.

„ *flava* Pers.

Perichæna depressa Lib.

Lycogala miniatum Pers.

The usual exhibition of Fungi was arranged in one of the rooms in the hotel, Over 100 species were labelled by the experts present.

After tea an Ordinary Meeting of the Club was held (being the 232nd), the chair being taken by Prof. R. Meldola, F.R.S., *Vice-President*.

The Chairman said that all would regret that illness prevented the President, Mr. Rudler, from being with the Club that evening.

Mr. E. H. Rhys Haries was elected a member.

Mr. T. Petch, B.Sc., exhibited living specimens of the slug *Limax tenellus* from Epping Forest (see page 342) and also living *Limax cinereo-niger* from High Beach, announced in July part of the *E.N.* (ante 299).

Dr. Cooke and Mr. Massee reported on the plants gathered during the foray, and shown in the room. And later Mr. Massee exhibited a series of Wall Diagrams, printed in colours, of some of the principal diseases of trees, and gave a running commentary upon the different species, explaining the diagrams. He then announced that the nine diagrams, of which these were advanced proofs, were part of a series which the Board of Agriculture had resolved to issue at a cheap rate for the benefit of those interested in arboriculture. On the tables were also exhibited a series of twenty coloured drawings by Dr. M. C. Cooke, illustrative of common plant diseases in the various stages through which they pass in the history of their lives.

It was announced that a complete and revised list of the Hymenomycetes of Essex, by Dr. Cooke and Mr. Massee, was in preparation, and would be published in the *ESSEX NATURALIST*; also that extra copies would be printed and sold at a moderate price to be used as check lists.

[The Editor has compiled the foregoing account from Dr. Cooke's report in the *Gardeners' Chronicle* for October 29th. A brightly written account of the Foray, extending to a column, appeared in the *Daily News* for October 20th.]

THE 233rd ORDINARY MEETING.

Saturday, October 29th, 1904.

The first meeting of the winter session was held as usual in the Technical Institute, Stratford, at 6.30 p.m., Mr. Walter Crouch, F.Z.S., *Vice-President*, in the chair.

New Members.—Mr. T. Petch, B.A., B.Sc., and Mr. F. A. Reichert were elected members.

Donations to the Museum.—The Secretary announced that Mr. Thomas W. Reader had presented a set of shells of mollusca, sectioned so as to show the structure. These were intended for a series now being prepared, demonstrating some leading facts in the morphology of the mollusca.

Also, that Mr. J. T. Winkworth had presented about 50 specimens of the shells of *Helix nemoralis* from near Harlow, Essex, serving to show the range of variation in this species in a single locality (see Mr. Winkworth's remarks, *ante*, pp. 256-7).

Also that Mr. D. Wright had given a small number of insects—Coleoptera, Hymenoptera, and Diptera—some being rare species.

The thanks of the Club were voted for these donations.

Ostrea angulata introduced into Essex.—Mr. W. Cole exhibited specimens of this small oyster from Portugal, which Dr. Plowright had detected attached to periwinkles sold in the streets in King's Lynn, and which were stated to have come from Southend or Brightlingsea.

Crepidula in Essex.—Also specimens of *Crepidula fornicata*, from Colne Point, St. Osyth, proving that this North American shell was extending its range in Essex (see E.N. x, 353).

Petricola pholadiformis and **Acera bullata** in Essex.—Mr. W. Cole exhibited specimens of these two molluscs from Walton-Naze, which had been kindly presented by Mr. J. E. Cooper.

Aberration of the Peacock Butterfly.—Also a specimen of *Vanessa io*, ab. *cyanostica*, from the coast at St. Osyth (see "Notes," p. 365).

Also aberrations of common butterflies taken this season, recorded in the "Notes," p. 366.

Warrants for Killing Deer in Epping Forest.—Mr. Avery exhibited and presented to the Club, for the Epping Forest Museum, two Warrants for killing deer in Epping Forest, dated 1810. These documents are on view in the Museum.

Gilbert Meeting at Colchester.—Mr. Walter Crouch gave an interesting description of the proceedings at the unveiling at Colchester on June 11th last, of the oil painting representing Dr. Gilbert explaining his electrical experiments before Queen Elizabeth (by Mr. A. Ackland Hunt), at which he had been present.

Chiselhurst Chalk Caves.—Mr. T. V. Holmes exhibited a plan, drawn by Mr. T. E. Foster, of the chalk workings at Chiselhurst, and in doing so made some remarks on the nature of the caves, which in his opinion were simply excavations for getting chalk, and bore no resemblance to the Denekholes of Essex and Kent. A summary of Mr. Holmes' remarks will appear in the **ESSEX NATURALIST**.

Photographs of Fungi.—Mr. C. M. Barnard showed by means of the lantern, a short set of excellent photographs of some of the fungi found at the Foray on October 15th last. These photographs had been taken by Mr. F. A. Reichert, and proved the value of photography in recording the "finds" of rare or interesting plants.

Thanks were voted for these exhibits and presentations.

Lecture.—Mr. D. J. Scourfield, F.R.M.S., then gave a lecture-paper on "Fresh-water Biological research and Biological stations." The paper was illustrated by examples of the apparatus employed and lantern pictures of the principal stations. In his introductory remarks, Mr. Scourfield said that such establishments were the necessary consequence of the marine stations that had been founded, and of the exploring work done by such expeditions as that of the Challenger. These had opened up unknown worlds, and accumulated a vast number of facts, which had to be dealt with by specialists. Something more was,

1 See Mr. Petch's note on p. 364.

however, necessary. The facts had to be co-ordinated, and the lives of the organisms considered with regard to their own environment, and as forming parts of a complex whole. Thus the foundation of marine stations was one factor that contributed to the institution of freshwater stations. Another was the question of fisheries, for freshwater fish was much more largely used for food on the Continent than in this country. Limnology, or the study of lakes, also played an important part in the development of freshwater biological research; and a very good example of work of this kind was that done by Dr. Forel in his investigation of the Lake of Geneva. The use of the net for obtaining water and the contained organisms at various depths was then explained, as well as the methods for calculating the numbers of any given species in a definite volume of water. These had to be studied as forming quite a little world of their own, for they were not in any way dependent on the shore. The supply of drinking water was another factor which had to be taken into account. Bohemia led the way in the matter of freshwater biological research with a portable wooden station, constructed in 1888 under the direction of Dr. Anton Fritsch, and this inaugurated on a small scale the systematic study of the fauna and flora of the European lakes, which has since been carried on more exhaustively elsewhere, and led to the establishment of the fine station at Plon, which was opened by Dr. Zacharias in 1892. Here the work was entirely biological; but in some other stations in Germany it was to a great extent economic, as was the case also in Russia, where it had direct connection with the fisheries. France had establishments of this kind, and good work had been done in Italy, which as yet had no station. America was well off in establishments where freshwater biological work could be carried on; some were supported by the Government, and others were connected with the various Universities. About 1896 the idea was discussed in this country, and there was now a private station, belonging to Mr. Robert Gurney, in the district of the Broads. The ideal of a freshwater biological station was a place where systematic and connected work could be done, on lines of its own, or supplementing that of the marine stations.

A discussion took place, carried on by the Chairman, Mr. Barnard, Mr. Wilfred M. Webb, F.L.S., and the Author. A cordial vote of thanks was accorded to Mr. Scourfield for his very interesting and suggestive paper.

Mr. Scourfield briefly replied, and the meeting ended.

THE 234th ORDINARY MEETING.

Saturday, November 26th, 1904.

The second meeting of the winter session was held in the Technical Institute, Stratford, at 6.30 p.m., the President, Mr. F. W. Rudler, F.G.S., in the chair.

Exhibits.—Mr. Cole exhibited some interesting specimens recently added to the Museum. Among them was a fine specimen of the Cephalopod, *Eledone cirrosa*, a dissection of *Sepia officinalis*, showing the internal organs, some beautiful preparations of fishes, demonstrating the circulatory and nervous systems, and a series showing transformations of the common frog, prepared from specimens bred up in the Museum.

Azolla (!) in Hainault Forest.—Also living specimens of an American aquatic plant (*Azolla pinnata*) which had been found floating in great abundance on the surface of a pond in Hainault Forest. It must have been an "escape" from some neighbouring hot-house, or possibly the plant had been purposely placed in the pond. It had evidently found the water to its liking, as the

fronds almost covered the surface, but it would in all probability die off when the winter's cold came on. It was a coincidence that Mr. L. B. Hall had found the plant in a pond at Highgate, flourishing under like circumstances.

Papers Read.—Mr. F. W. Reader read a paper, "Further Notes on the Lake-Dwelling Settlement at Skitts Hill, Braintree." The paper (which was illustrated by a number of lantern-slides) dealt mainly with points of detail concerning the depth of the "relic-beds" described in Mr. Kenworthy's paper already published in the *ESSEX NATURALIST* (Vol. xi., pp. 94-126). Mr. Reader's paper will be published in due course.

A short discussion was carried on by the President, Prof. Meldola, and the Author, and a vote of thanks was passed to Mr. Reader.

Coast Erosion in East Anglia.—Mr. John Spiller, F.I.C., F.C.S., gave a short lecture on this subject, consisting mainly of a summary of his own observations on the coast-line from Dunwich to Covehithe since his Report to the British Association in 1895. Having referred to the importance of the subject of coast erosion, as evidenced by the papers recently presented to the Institute of Civil Engineers and to the Norwich Conference, Mr. Spiller said that, with the exception of Yorkshiresmen, East Anglians were the people most interested in the matter. Erosion was going on all around the coast, from Cromer to Walton-on-Naze, and Lowestoft had spent £68,000 in defensive works. For many years he had taken measurements systematically, and had compared his results with the figures returned by members of the Geological Survey. The photographs he submitted of Dunwich showed the recent fall of the land east of the church, carrying with it about 6ft. of the northern buttress of the church. Here 31ft. had been lost in two years; at Temple Hill, close by, 55ft. disappeared in the same period. From the cliffs North and South the fall had been greater, and the lifeboat could not be used, for much of the shingle had been carried away, and the boat-house was left perched on a terrace. Northwards, to the mouth of the Blyth, the shingle had been cut back; but at Southwold the lengthening of the old pier and the erection of a new one had increased the width of the beach, though the lifeboat-house was still threatened. In the last nine years, 350ft. had been lost from the cliff at Easton, 163ft. from the roadway, and 77ft. from the High Cliff. And these figures would have to be increased, for there had been much destruction since they were verified in the early summer. At Covehithe, where his personal observations ended, 129ft. had been lost in the same period. In conclusion, Mr. Spiller expressed a hope that some members of the Club would undertake similar observations from Harwich to the mouth of the Thames.

Some discussion ensued, carried on by the President, Mr. Avery and Prof. Meldola, who pointed out that the disintegration of the cliffs was due to terrestrial and subærial forces—such as land-springs, wind, and rain—and what fell was carried away by the sea.

In answer to a question, Mr. Spiller said that the gain of the land upon the sea amounted to about one-fifth of the loss.

A vote of thanks to Mr. Spiller for his address was proposed by the President, and carried by acclamation.

Professor Meldola having taken the chair, Mr. Rudler gave his report as the Club's Delegate at the Cambridge Meeting of the British Association. [This report is printed in the *E. N.*, ante, pp. 337].

Professor Meldola remarked on various recommendations in the report, and Mr. Rudler was warmly thanked for the summary of the proceedings, and for his kindness in representing the Club at the Conference.

NOTES—ORIGINAL AND SELECTED.

ZOOLOGY.

BIRDS.

Period of Incubation of the Robin.—The following extract from one of the "Nature Note-Books" kept by the senior girls of the Leyton County School seems worthy of record, as little is known of the period of incubation of our common birds. Miss E. Drayson writes:

"In the garden (Woodford) are several wooden boxes, which are covered with glass in winter, in order to preserve the plants inside from the frost. In the spring the glass is removed in the day-time and put on at night. This spring (1904) an empty one had the glass broken, and a pair of robins built a nest inside, and laid eggs in it. The eggs were five in number; the first was laid on Thursday, April 7th, and the last on the 11th, after that the bird sat on them all day. On the 18th the robins were hatched, but on the 24th the cats got at them and killed all the young birds."

A series of observations of this character, with particulars of the weather during the time, would help to fill the gap which exists at present in our ornithological knowledge.—T. PETCH, Leytonstone.

Protection of Birds in Essex.—The work and successes of the Essex Bird Society have been frequently brought before the readers of the *ESSEX NATURALIST*, and the progress made in 1903 was admirably summarised by the *Hon. Secretary*, Mr. Francis Dent, in his paper *ante* pp. 194-6. The recently-published Report for 1904 now lies before us, from which it appears that the shore-breeding species, especially the Black-headed Gull and the Terns, are steadily increasing in numbers. In both the Harwich stations, it is reported that the breeding has been good the ducks and plovers thrive well, and there has been an increase in coots, "sea gulls," and kittiwakes. At St. Osyth there were more gulls breeding on the marshes, and more terns were seen than for two or three years past. A good season for plovers and coots is reported there. Free breeding is also noted at Brightlingsea, West Mersea, Tollesbury, and Burnham. The St. Osyth watcher writes:—"I think that the Protection Order has done good. It would be better and less confusing if we had one close time for the East Coast instead of two different dates for Essex and Suffolk." From Epping Forest and the adjoining estates under Mr. E. N. Buxton's "League" (see

ESSEX NATURALIST, ix. 49 and x. 56), it was reported that owls continued to increase. Kestrels, sparrow-hawks and magpies remained about constant. Small birds were very numerous, and the gold finch is on the increase, and has nested in regularly increasing numbers.

MOLLUSCA.

Ostrea Angulata, an introduced Mollusc, at Southend.—In 1903, Dr. C. B. Plowright sent me specimens of *Ostrea angulata* attached to periwinkles which had been bought in the Lynn market.

In October, 1903, I visited Southend and found full-grown specimens attached to stones, mussels, and oyster shells. They were picked up, dead and alive, on the tide mark from Southend gas works to Shoeburyness. The thickness of the shell makes it more liable than other oysters to be rolled about by the water, and hence many of them were so worn they could only be distinguished from oval stones by their regular black and white banding.

On making enquiries I was fortunate enough to meet a Southend dealer who supplied the Lynn market. He informed me that this oyster was introduced from Portugal for cultivation in the Thames Estuary, but they were considered too small, and so their owners "loped 'em overboard"; but again, unlike other oysters, the spat settles readily, so that they are now well distributed.

As this species was offered for sale in the Southend shops, I thought it unnecessary at the time to call any attention to its occurrence.—T. PETCH, B.Sc., Leytonstone.

Testacella Haliotide, Drap., at Colchester.—Dr. Chichester yesterday brought me in a specimen of this subterranean carnivorous slug, which had been found in his garden at Crouch Street, Colchester. This is the only Essex example that has come under my notice.—HENRY LAVER, F.L.S., March 22nd, 1904. [The only previous records we have are those by Mr. Webb at Stisted and Widford. ESSEX NATURALIST x, 31, and *Journal of Essex Technical Laboratories* ii., 127, 242.]

Arion Intermedius Norm. (*A. minimus* Simroth) in Epping Forest.—This slug is not recorded as an Essex species in Mr. Wilfred Mark Webb's "Non-Marine Mollusca of Essex" (ESSEX NAT., vol. x.). During the last four years I have

frequently observed it in Wanstead Park, and in almost every part of Epping Forest. Specimens gathered on fungi at the last Fungus Foray were submitted to Mr. J. W. Taylor.

Helix aculeata, common in Wanstead Park, is an addition to Crouch's "List of the Mollusca of Beacontree Hundred." (*E.N.* vol. iv.)—T. PETCH, Leytonstone.

INSECTS.

Leucophæa Surinamensis, Linn. in Essex.—This pretty cockroach has occurred abundantly in a tan-pit adjoining the greenhouses of a private garden between Chelmsford and Bloomfield and is doing considerable harm to the pineapples, orchids and other plants. In Mr. Burr's *British Orthoptera*, published in 1897, the occurrence of two individuals at Bognor, Sussex, and one at Kew, is mentioned, but Mr. Burr states that "it hardly deserves to be called British until it is proved that it actually breeds here." There is no doubt of its breeding in the present locality, as it has been established for several years, and the specimens brought to me are of every age and size from recently hatched young to mature insects. The gardener who submitted the specimens to me does not know how they came, but in the past few years numerous tropical plants have been brought into the garden, and the cockroaches may have been brought with one of them. I have sent specimens to the British Museum collection, and my naming has been confirmed there, and I am also sending specimens to the Essex Field Club Museum.

Since writing the above, I hear from Mr. W. H. Harwood, of Colchester, that about 30 specimens have recently been found near Liverpool and Manchester.—E. CHARLES HORRELL, F.L.S., County Laboratories, Chelmsford. [According to Burr, *L. surinamensis* is a cosmopolitan species, being found throughout the tropics, Brazil, Cayenne, Martinique, Senegal, China, Java Philippines, Mexico, Central America, British Columbia, Burmah, etc.—ED.]

Vanessa Io, var. cyanostica, at St. Osyth.—This form, which was first observed and named by the Rev. G. H. Raynor, of Hazeleigh, differs from the normal *io* in the possession of a single blue spot beneath the "peacock eye" on the hind-wings of the butterfly. I netted many "Peacocks" at St. Osyth last

summer to no purpose, but on a sunny but breezy afternoon towards the end of August I was on Sandy Point, St. Osyth, and noticed a solitary *io* hovering over a patch of sea lavender. This specimen, on being boxed, proved to be the long-sought for *cyanostica*. I carefully examined a large number of specimens until the middle of September, but could not find another. *Vanessa atalanta* and *V. urtica* were common in the clover-fields, but I saw only two *C. cardui*.—B. G. COLE, Buckhurst Hill.

Aberrations of *Epinephele Janira* and *E. Tithonus*.—

At St. Osyth last August I met with two or three nice aberrations of these species. *E. janira* was, of course, very abundant. Two specimens of the female were caught, in which the usual fulvous patch was of a yellowish-white colour. Among the thousands of *E. tithonus* which were fluttering over the blackberry bushes I picked out a female specimen, the left forewing of which was of a silvery-white colour, the other wings being normal. In meadows, near Chigwell Row, occurred (in 1902) a male of *E. janira* in which the light patches were putty-coloured.—B. G. COLE, Buckhurst Hill.

BOTANY.

Uncommon Plants in Epping Forest.—Among the plants observed in recent years by the students of the Leyton County School are, *Orobanche major*, on roots of broom, Epping Forest, near Cook's Folly, 1902; *Utricularia (vulgaris ?)*, common in ponds in Epping Forest, 1903-4; Bee Orchis, *Ophrys apifera*, Epping Forest, June 19th, 1904, Miss L. Berry. The *Utricularia* has not been observed in flower.—T. PETCH, Leytonstone.

GEOLOGY.

Changes in the Essex Coast.—For several years the British Association has been receiving, by permission of the Admiralty, systematic reports from the Coastguards, with reference to changes in the coast of Great Britain. A great mass of matter has thus accumulated in the form of tabular returns, and an analysis of this material, by Mr. John Parkinson, has recently been published by the Association. The following is the only information given with regard to Essex :—

“Concerning the coast from *Harwich to the Roach River*, observations from

thirteen stations provide evidence of little change, since ten record no alteration—a result no doubt of the artificial protections.

“A gain is reported from Walton-on-the-Naze following the lengthening of the pier, and a loss from near Harwich Harbour, where the sea-wall is broken in, with local slips at Clacton at unguarded spots. Every station is protected, usually with sea-walls; while Harwich, Walton, Clacton, and the eastern side of Mersea Island are provided with groynes. Shingle is removed in small quantities from Harwich, Clacton, Colne Point, and from the southern side of the Blackwater River.”

A map, showing the changes all round the British Coast, accompanies the original report.—F. W. RUDLER, F.G.S.

Post-Glacial Deposits of Walton Naze.—The interesting extract, given by Mr. Holmes on pp. 295-6, goes far to support the suggestion which I tentatively advanced in 1889 (*ESSEX NAT.*, vol. liii., pp. 223-241), as to the possibly Post-glacial age of the upper clay and gravel capping the Naze cliff. The palæontological evidence wanted had in fact been found in 1803, and buried in the *Annual Register* till re-discovered by Mr. Holmes. This harmonizes all the East Essex gravels from Southend to Harwich (where doubtless the cliff-capping is of like age), an early deposit of the Thames, when its mouth was in a common estuary with all other East-British and many West-European rivers.—W. H. DALTON, F.G.S.

METEOROLOGY.

Rainfall of 1903.—A letter from Dr. H. R. Mill, in the *Times* of Jan. 88, 18904, which, with tables, occupies more than two columns, gives the amount of the rainfall of 18903 as taken at 62 stations in all parts of the British Isles. Dr. Mill informs us that the rainfall was everywhere in excess of the averages “The rainfall of London in 18903” (he remarks) “was greater by at least three inches than in any other year for which records exist, but a like unprecedented excess occurred at only a few of the stations outside the lower Thames valley.” Considering the areas over which the percentage excesses were greatest, Dr. Mill finds that they were three in number: the south of England from about Swanage to near Brighton, running northward to include the whole of the Thames Basin, and extending beyond it northward from London. The second very wet area occupied North Wales and the west of Cheshire and Lancashire. The third lay in Scotland, north of the Caledonian Canal. “The

driest areas relative to the average, and probably the driest absolutely for the year, seem to have been in Norfolk and in a narrow strip running from south of Leicester through Lincoln to Hull. Here the excess was under 10 per cent." Dr. Mill states that "Over the British Isles as a whole the rainfall was certainly considerably more than 25 per cent. above the average, and England, Scotland, and Ireland differed little in the amount of the excess."

At Shoeburyness, the only Essex station mentioned, outside the London district, the rainfall was 29.52 in., the average from 18870 to 18899 having been 89.75 in. Within the London district the rainfall at Leyton (Lea-bridge road) in 1903 was 36.64 in. ; at Greenwich Observatory 3.54 in. ; at Camden Square 388.0 in. ; and at the Victoria and Albert Museum, Kensington, 42.37 in.—T.V.H.

MISCELLANEA.

An Early Electrical Experiment in Essex.—The following incident in the life of Benjamin Wilson, F.R.S., the celebrated portrait-painter, father of General Sir Robert Wilson, may be of interest:—"In 1747 Dr. Franklin published his discovery of the identity of lightning with electricity. Wilson's attention was immediately awakened. On the occurrence of the first succeeding thunderstorm he happened to be at the house of a friend near Chelmsford, in Essex, and at the moment was acting, with others, one of Shakespeare's plays. He was playing the part of Henry IV. when the storm came on, and running out in his royal robes he extemporised an apparatus to test the discovery—a curtain-rod inserted in a clean, dry quart bottle, with a pin (or needle) fastened to it at the other end. The bottle he held in his hand as he stood upon the bowling-green, and the fluid was collected in the rod so that sparks were drawn from it by himself and all the rest. On the same day the same effects were observed by Mr. Canton in London, and this storm was the first occasion of the experiment being tried in England."

1 *Life of General Sir Robert Wilson*, by the Rev. Herbert Randolph. 1862, Vol. 1, p. 11.

END OF VOLUME XIII.

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At Shoeburyness, the only Essex station mentioned, outside the London district, the rainfall was 29·52 in., the average from 1870 to 1899 having been 19·75 in. Within the London district the rainfall at Leyton (Lea-bridge road) in 1903 was 36·27 in.; at Greenwich Observatory 35·54 in.; at Camden Square 38·10 in.; and at the Victoria and Albert Museum, Kensington, 42·37 in.—T.V.H.

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¹ *Life of General Sir Robert Wilson*, by the Rev. Herbert Randolph, 1862, Vol. 1, p. 11.

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The Essex Museum of Natural History (*Romford Road, Stratford, Essex*) is designed and arranged as a Local Museum for the County, and as an Educational Museum for use of the general public, students and schools. Included in the scheme is a Lecture-room for Demonstrations and the aid of a growing library of works on subjects illustrated in the museum. *Curator*, W. COLE. *Assistant*, HENRY WHITEHEAD.

The Epping Forest Museum, established by permission of the Corporation of London in Queen Elizabeth's Hunting Lodge, Chingford, Essex, is devoted to the elucidation of the Natural History and Antiquities of Epping Forest, and as a centre for Nature-study for schools and young naturalists. *Honorary Curators*, W. COLE, B. G. COLE, and H. A. COLE.

The Libraries of the Club include works on Natural History, Geology, Antiquities, and Epping Forest (*special*). *Honorary Librarian*, THOMAS W. READER.

The Photographic and Pictorial Survey of Essex has been founded for the preservation of photographs, pictures and maps, etc., illustrative of the topography, antiquities, social habits, natural history, etc., of the County. The collections will be stored in the Essex Museum, and will be available for reference on application to the Curator. *Hon. Secretary*, VICTOR TAYLOR, Buckhurst Hill, Essex.

THE
ESSEX NATURALIST:

BEING THE

Journal of the Essex Field Club,

EDITED BY

WILLIAM COLE, F.L.S., F.E.S.,

Honorary Secretary.

VOLUME XIV.

JANUARY, 1905—DECEMBER, 1906.

"Men that undertake only one district are much more likely to advance natural knowledge than those that grasp at more than they can possibly be acquainted with. Every kingdom, every province, should have its own Monographer."—GILBERT WHITE, of Selborne,

"Things seen are mightier than things heard."—TENNYSON.

[The authors alone are responsible for the statements and opinions contained in their respective papers.]

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OF NATURAL HISTORY, STRATFORD, ESSEX.

1906



J. J. Lowell fund

"To the attentive eye, each moment of the year has its own beauty."

EMERSON.

*"If you have seen, as I have seen
One morning in November,
The sun burn through a foggy screen
Like some red glowing ember,
While yellow leaves from pencilled trees
Fly down like small canaries—
If you have caught a glimpse of these,
Then you have seen the Fairies !*

*"If you have heard above the roar
Of traffic in the city,
The gentlest pecking at your door,
The faintest chirp for pity,
If scattered crumbs from off your plate
Have made brown wings the fleetier,
Then you have walked right through the gate
Whose keys are held by Peter !"*

ROSE HENNIKER HEATON.

*. . . . "The only real gain of wealth is that represented by the
storage of energy from without, which comes to us by the action
of green leaves waving in the sunshine."*

Prof. H. MARSHALL WARD.

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¹ Note. - The Plates may either be arranged as indicated, or placed together at the end of the volume.

ERRATA.

- Page 3 line 17 from foot, for "~~prominently~~" *read* prominently.
 „ 32 line 12 from foot, for "Americian" *read* American.
 „ 61 bottom line, for "1900" *read* 1893.
 „ 69 line 9 from foot, for "Frankport" *read* Frankfort.
 „ 128 line 8, for "that" *read* than.
 „ 150 line 16 from foot, *delete* more.
 „ 160 line 8, after "Epping" *add* Forest.
 „ 165 line 9 from foot, for "orcadensis" *read* scomerensis.
 „ 235 line 11 from foot, for "hygrometer" *read* hydrometer.
 „ 236 line 13 from foot, for "45" *read* 44.
 „ 257 line 5 from foot, for "principal" ~~read~~ Principal.
 „ 258 line 18 for "precedence" *read* precedence.
 „ 268 line 7 from foot, after "Essex" *insert* Field Club.
 „ 269 line 23 from foot, for "Amesbresbury" *read* Ambresbury.
 „ 274 lines 10 and 14, for "mistakeable" *read* mistakable.
 „ 274 lines 12 and 15, for "remainæ" *read* remanié.

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WILLIAM COLE, F.L.S., F.E.S.,
Honorary Secretary and Curator.

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[This Part contains the first Instalment (nine) of the Twenty-five Plates by Mr. C. Sillem, which will be used to illustrate the Monograph on the British Woodlice.]	
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THE ESSEX FIELD CLUB.

Membership of the Club.—Information respecting Membership and the work of the Club, with forms of proposal, will be sent on application to the Hon. Secretaries, at the Headquarters.

The Essex Museum of Natural History (*Romford Road, Stratford, Essex*) is designed and arranged as a Local Museum for the County, and as an Educational Museum for use of the general public, students and schools. Included in the scheme is a Lecture-room for Demonstrations and the aid of a growing Library of some of the most useful monographs of British Geology, Botany, and Zoology, *for the use of Students in the Museum.* Curator, W. COLE. Assistant, HENRY WHITEHEAD.

The Epping Forest Museum, established by permission of the Corporation of London in Queen Elizabeth's Hunting Lodge, Chingford, Essex, is devoted to the elucidation of the Natural History and Antiquities of Epping Forest, and as a centre for Nature-study for schools and young naturalists. *Honorary Curators*, W. COLE, B. G. COLE, and H. A. COLE.

The Libraries of the Club include works on Natural History, Geology, and Antiquities, with a special department of books, pamphlets, and MSS. relating to Epping Forest. *Honorary Librarian*, THOMAS W. READER.

The Photographic and Pictorial Survey of Essex has been founded for the preservation of photographs, pictures and maps, etc., illustrative of the topography, antiquities, social habits, natural history, etc., of the County. The collections will be stored in the Essex Museum, and will be available for reference on application to the Curator. *Hon. Secretary*, VICTOR TAYLOR, Hurstleigh, Buckhurst Hill, Essex.

THE
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BEING THE

Journal of the Essex Field Club

FOR 1905-1906.

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ON NATURAL HISTORY MUSEUMS.

*An Address delivered to the Essex Field Club at the Annual Meeting,
April 8th, 1905,*

By F. W. RUDLER, I.S.O., F.G.S., *President.*

THE members of the Essex Field Club have met together on this occasion under circumstances of an exceptionally interesting character. As pointed out in the notice convening this meeting, the Club has now completed the twenty-fifth year of its history. Not only has it gone on for a quarter of a century regularly holding its evening meetings and its field meetings, but during this long period it has enjoyed the advantage of retaining uninterruptedly the services of its Honorary Secretary and Founder, Mr. William Cole. Moreover, for nearly the whole of this long term he has been associated in the Secretarial work with Mr Benjamin G. Cole. This exemplary devotion of two brothers to the service of our Club—not to mention the valued assistance of Mr. Henry A. Cole and of the ladies of the family—seems to me deserving of some recognition, more substantial in character than the verbal thanks formally voted at an Annual Meeting. But Mr. W. Cole, having the interest of the Club ever at heart, assured us some time ago that the recognition of the twenty-fifth Anniversary which would best please him would be the means of completing the Epping Forest Museum. Just as the Club itself originated with Mr. W. Cole, so this museum owes to him its initiation; and it is consequently but natural that he should desire to see his ideas brought to maturity. Whatever, therefore, may be done on some future occasion, our immediate attention should be given to this modest suggestion with regard to the Forest Museum; and I think I cannot do

better than seize the opportunity afforded by the Annual Meeting to plead very urgently on behalf of this part of the work of our Club.

It should be our proud endeavour to make the little Museum in the old Hunting Lodge an attractive centre of scientific instruction to the multitudes who visit the Forest every season. To do this is by no means an easy matter. It requires much knowledge and great skill, a good deal of labour, and a little money. If the Club undertakes to furnish gratuitously the knowledge, the skill and the labour, surely it is not unreasonable to expect the money to be forthcoming from some other source. As a matter of fact, however, the members of our Club have done much themselves in furnishing funds, but their donations, though generous, are still insufficient for the work at present contemplated. According to a recent estimate the sum of £200 is now required to bring the arrangement of the Museum within a reasonable approach to completeness. With this moderate sum, it is believed that it would be possible to procure such glass-cases and specimens as are urgently needed to make the museum representative of the Natural History of the Forest District. It seems absurd that a work of this importance should be delayed through any difficulty in raising so comparatively trifling a sum!

The Museum at Chingford may be regarded as a Monograph of the Natural History of the Forest, illustrated with realities and not semblances—a monograph which may be read by every visitor more readily, yet more profitably, than any illustrated book. Instead of turning over the pages of a volume and admiring the plates, the visitor passes from case to case, seeing in most instances the veritable objects instead of their mere presentment on paper, and learning about these objects many a useful lesson from the descriptive labels, with which they are invariably accompanied. In a "Museum Leaflet," issued by our Club ten years ago, Mr. W. Cole explained the purpose of the Museum to be two-fold; first, to "promote a love for the out-of-door study of Natural History, etc., among the intelligent visitors to the Forest," and secondly, "to form a store-house for the preservation of authentic series of forest-specimens."⁽¹⁾ Both these objects have been already, to a great extent, fulfilled—

(1.) *A short account of the Epping Forest Museum. E.F.C. Museum Leaflets, No. 1. 1895.*

fulfilled, indeed, so far and in such way as our means have permitted.

As many of our members may not have visited the Forest Museum recently, it may not be without use to explain what has already been done there, and what more it is intended to do, provided the necessary funds are forthcoming. Even in its present incomplete state the Museum is a source of much attraction to the crowds of excursionists in the summer months. It appeals to many who might not otherwise be attracted to a Museum. A visitor to the forest will casually enter the Lodge, and have his attention arrested by the collections, whereas he might never think of making a definite visit to a Museum in town. And who dares to guess what far-reaching results may perchance flow from such an accidental introduction! It may be true as Oliver Wendell Holmes said, that the ordinary visitor to the British Museum "will know as much about it as the fly that buzzes in at one window and out at another." But that, I believe, is due mainly to the bewildering wealth of our National Treasure-house. A small museum is likely to have in some respects much more educational value than a large one; and just because our Forest Museum is not embarrassingly rich in specimens, I venture to assess its value as altogether out of proportion to its magnitude. That remarkable man, the late Professor Rolleston, remarked that "a young man who is possessed of a talent for Natural Science and Physical Inquiry generally, may have the knowledge of this predisposition made known to himself and to others, for the first time, by his introduction to a well-arranged Local Museum."⁽²⁾ Is it unreasonable to hope that some bright spirit—perhaps some 'potential Darwin'—may date his inspiration from a casual visit to that little Museum in the Forest?

Obviously the first thing that claims attention in a forest is its timber; and hence a Forest Museum must contain, first and foremost, illustrations of the *Forest Trees*. Of the throngs of Londoners who visit Epping Forest, how small a proportion could name the common trees, even when clad in all their livery of green! I heard of a Cockney who, failing to distinguish one tree from another, grouped the oak, the beech, the elm, and a

(2) Address to the Biological Section of the British Association at Liverpool, 1870. *Report*, p. 93.

number of others together under the vague name of "the ordinary tree."⁽³⁾ It is not contended for a moment that a man will be a better citizen because he calls an oak *Quercus*, and a beech *Fagus*; but it is undoubtedly true that the man who marks the essential points of difference between one tree and another—who can distinguish, say, the hornbeam from the beech or the elm—is a man who exercises his faculties of observation, and to that extent is likely to become a better workman and a more intelligent member of Society.

Ignorance of the forest trees may readily be overcome by a little study of the specimens, which are already shewn in the museum, mounted in glass-cases affixed to the wall on the great staircase and on the landings. Here the visitor finds preserved specimens of the foliage and the fruit, with sections of the wood, and photographs of the trees shewing their characteristic habit; whilst in some cases, the diseases of the trees have been illustrated by Mr. Paulson.

The *Herbaceous Flowering Plants* of the forest are illustrated during the season by specimens of cut flowers, duly labelled—a source of never-failing interest to the procession of young people who pass through the rooms at holiday time. The frequent change of fresh flowers involves, however, much work; and it seems to me desirable that some of our members living near the Museum should offer to assist the Curator in this respect. Botany is a subject much cultivated by many ladies, and it would surely be an interesting occupation for ladies of leisure to collect the plants and label them, giving with the name a brief note which might include, if nothing else, scraps of folk-lore, such as may readily be found in popular works on wild flowers. Such information, neatly expressed, makes very pleasant reading, and would render the plants attractive even to those who have no aspiration to become botanists. "Of the many thousands who visit us on every sunny day in summer," says Mr. E. N. Buxton, "few return without securing some floral trophy, which it has given them infinite pleasure to gather."⁽⁴⁾ Would it not be well that they should carry off with their trophy some interesting scraps of information, which will abide long after the flowers themselves shall have perished!

(3) *Landscape Geology*. By Hugh Miller, 1891. p. 38.

(4) *Epping Forest*. By Edward North Buxton, Verderer. London, 1885., p. 114.

Dried plants are not readily exhibited, and if exhibited are not generally attractive. It is true they may be mounted in frames and glazed, but they require much space for their display upon the wall. A preferable mode is to hinge the glazed frames to an upright standard, so that they be made partially to revolve. The proper course, however, is to preserve the specimens in an herbarium, and to consult them as books may be consulted in a library.

Fortunately our Club possesses a good collection of dried plants, preserved in eight cabinets, now in the Stratford Museum. This herbarium includes the important donation of specimens due some years ago to the generosity of Mr. J. C. Shenstone ; it contains also the late Mr. Sewell's collection, presented by his widow ; Mr. E. J. Powell's herbarium, and Dr. Varenne's collection of Cryptogams. I understand from Mr. W. Cole that he is about to arrange these herbaria in two series—the one a general collection of British plants for the use of the student ; the other limited absolutely to the Flora of Essex.⁽⁵⁾ Our local herbarium will be invaluable to future botanists, inasmuch as we possess representatives of plants from numerous localities in Essex now built over or otherwise lost to science.

A large number of our Essex specimens have been obtained from the Forest district, but it hardly seems desirable to remove these to the Forest Museum, inasmuch as there they could scarcely be exhibited to advantage. Although an herbarium is clearly of the highest value to the student of systematic botany, it is hardly a suitable object for public exhibition. Indeed Prof. Weiss, of Manchester—a very high authority—has said “I regard the Herbarium as not forming part of a Museum.”⁽⁶⁾ Probably the ordinary visitor would find good coloured plates of the flowers of the Forest more serviceable than dried specimens ; for these have generally lost to a large extent their colour and even their shape, so that the tyro would be more likely to identify his specimen from a well-executed coloured plate than from the dried plant.

It is said, I believe, that among English counties Essex stands second only to Herefordshire in the interest of its *Fungi*.

(5) On the arrangement of dried plants see a paper by Mr. E. M. Holmes, F.L.S., on “The Arrangement of Herbaria.” *Report of Museums Association*, Sheffield, 1899, p. 63.

(6) “The-Organization of a Botanical Museum.” By F. E. Weiss. *Rep. Mus. Assoc.*, Manchester, 1892, p. 25.

Our Club indeed has become rather famous for its annual Fungus Forays in the Forest. Some of the common fungi of Epping Forest are so conspicuous as to attract general attention, and it should always be the object of our Museum to enable a student—or even a chance visitor—to identify any natural object which he may find in the course of a Forest ramble. In the Museum at Chingford there is a good collection of preserved specimens of the local fungi, accompanied by coloured drawings, and well displayed in a series of wall-cases. Some of the specimens, I believe, were prepared by that skilful naturalist, the late Mr. English, of Epping. Nor should we omit to notice the set of original drawings of flowerless plants, executed specially for the Museum by our veteran friend, Dr. M. C. Cooke. This series of large drawings, framed and glazed, is mounted on screens in the Upper Room of the Museum, where it offers in an attractive form much information to the visitor.

So far as the zoology of Epping Forest is concerned, popular interest seems to centre in the *Insects*—if, at least, we may judge from the large number of visitors who carry butterfly-nets and other entomological gear. The Curator, whom we all know to be an enthusiastic entomologist himself, has done well to minister to their tastes by a remarkably fine display in the Oak Room. Here the instructive specimens illustrating the life-history of the Forest butterflies and moths, with their food-plants, is especially noteworthy. As most insects suffer deterioration by the action of light, they are here preserved in flat glass-cases, which are provided with covers that may be freely opened by the public, whilst the covers themselves are glazed and serve for the display of a most attractive series of coloured plates of insects, taken, I believe, from Curtis's *Entomology*. The effect of this admirable method of utilizing the covers of the cases contrasts very favourably with the ordinary practice of screening the specimens from light by means of moveable covers of American cloth, or other opaque material—a method which is rather unsightly and decidedly uninformative.

With regard to the *Mollusca*, reference should be made to the fine collection of land and fresh-water shells from the woods and lanes, the ponds and streams, of the Forest District, which has been on loan for many years by the courtesy of Mr. Walter Crouch, by whom they were collected and to whom the Museum

has so often been in other ways greatly indebted. The educational value of this collection is much increased by Mr. Crouch's neat drawings of the living molluscs, shewing their relation to the shells. I understand that a large collection of Forest species is in course of preparation, and as this is the property of the Club it will be a permanent exhibit. It is well to note, too, that some of the living mollusca will be on view in the aquaria in the museum, and I feel sure these will prove a constant source of interest and instruction to the visitors. The fascination of living things makes an aquarium one of the most popular features in any Museum, and amply repays the trouble which it necessarily involves.

It is not so easy to represent the *Vertebrata* of the Forest in our small Museum as it is to illustrate the invertebrate fauna. There is, however, in the Banqueting Hall a collection of *Birds' Eggs* (founded on a collection presented by Mr. G. E. Vaughan), in glass-topped boxes; and as many eggs suffer by direct exposure to light, they are protected, like the insects, by covers to the table-cases in which they are preserved. These glazed covers are utilized by the display of a charming series of coloured plates and reproductions of photographs, illustrating the residents, migrants and visitors to the forest, with their nests. The effect of thus appropriating what would otherwise be bare covers is admirable; but let it not be forgotten that the judicious selection, the neat mounting, and the careful labelling of such a series of plates, must have required the expenditure of much time and thought. It is evident that some sympathetic hand must have been busy with this work, and I think I trace that of Mr. Henry Cole.

At present there is no collection of stuffed birds in the Museum, but it is proposed, as soon as sufficient funds are in hand, to place in the centre of the Banqueting Room a pedestal case, divided into four compartments, each containing a small collection of the *Birds* of the Forest, in association with their natural surroundings. What species are to be represented I know not; perhaps it is not yet decided. But in view of the great interest of the Heronry in Wanstead Park, I should think that a group of herons, with the nest, would be at once appropriate, attractive and instructive. Fortunately the Club has, in its new president, a distinguished ornithologist, under

whose guidance we may be sure that the birds will receive due attention. It is also intended, our purse permitting, to erect a case in the middle of the Oak Room, on the lower floor, with a collection of the small *Mammals* of the Forest, showing their natural environment. At present the Forest mammals are represented only by a few examples of heads and antlers of the fallow deer, the red deer, and the roe deer—with one stuffed specimen of the forest breed of fallow deer.

In the picturesque mounting of natural objects, we cannot hope to imitate the splendid groups in the British Museum (Natural History), or even to vie with those of the large Provincial Museums, such as the fine pictorial groups by Mr. Montagu Browne, at Leicester. But even in a small way, we may be able to invest our stuffed birds and mammals with a touch of living interest. Instead of mounting them in the time-honoured fashion on polished pedestals of wood, we may at least encircle them with something suggestive of their forest-surroundings. The realistic adjuncts of a "habitat group" appeal especially to the young visitor; and a young visitor is always worth attracting.

Although the pictorial mounting of natural history objects has been brought prominently forward in recent years, it is by no means a new thing in Museums. In the early years of the last century, there existed at the Egyptian Hall, in Piccadilly, in connection with Bullock's famous Museum, an exhibition called the *Pantherion*. The conception was much too ambitious, since it aimed at representing, as far as possible, the whole of the mammalia, but its merit and novelty lay in the attempt to convey, in the words of its projector, "a more perfect idea of their haunts and mode of life than has hitherto been done."⁽⁷⁾

By means of a tropical scene, with models of appropriate vegetation, such creatures as the lion, the elephant, the rhinoceros, and the giraffe were "exhibited as ranging in their native wilds and forest." With regard to our unambitious Museum at Chingford, it seems in the highest degree desirable that we should be able to set up without further delay a few groups of local birds and mammals, under conditions suggestive of a glimpse of wild nature in Epping Forest. Nature-study is making us now-a-days

(7) *A Companion to the London Museum and Pantherion*. By William Bullock. London. 1816 (17th Ed.) p. 97.

rather impatient of artificiality, and indeed the naturalistic idea is even being extended from the Museum to the Menagerie. Just as people are not satisfied to-day with seeing in our glass cases stuffed birds perched in rows on monotonous stands of turned wood, so they are getting rather tired of seeing wild animals pent up in rows of cages; and Mr. Hagenback is said to have in view a scheme which will enable him in the near future to exhibit the animals under conditions apparently approaching to some extent those of nature.

At the present time there is displayed in the Upper Room of the Forest Museum a small collection of *Fossil Vertebrata*, representing the ancient fauna of the district; but the question is under consideration, whether it would not be expedient to remove these objects to Stratford, and devote the space at Chingford, which is but very limited, to illustrations of the fauna and flora of the Forest as they exist to-day.

Whilst the Chingford Museum makes natural history its most prominent feature, it has always sought—and quite legitimately—to illustrate the early archæology of the district, especially the *Prehistoric ages*. Hence we find in the Banqueting Hall the interesting collection of relics which were dug up from the two Forest camps—the camp at Amesbury Banks explored by our Club in 1881, and Loughton, or Cowper's Camp, examined in the following year, both probably of British origin. Then again the same room contains the valuable group of antiquities obtained by Mr. Chalkley Gould in the course of his exploration of the Romano-British settlement at Chigwell, and so well described in his *Museum Handbook*.⁽⁸⁾

The mention of antiquarian relics raises a suggestion which, to some, may appear rather startling. Will the day ever come when it will be possible to divorce these relics from the natural history objects with which they are now associated, so that the works of art may be shewn in one building and the works of nature in another? It is true that Sir Thomas Browne, that grand old East Anglian worthy, quaintly says that "All things are artificial, for nature is the art of God." But taking words as common-place people like ourselves use them, there seems ample justification for separating, under certain conditions, the

(8) "Notes upon the Romano-British Settlement at Chigwell, Essex." By I. Chalkley Gould, *Essex Field Club Museum Handbooks*, No. 2, 187.

artificial from the natural, and recognizing two groups of objects appealing to two types of visitor, not always in sympathy with each other's tastes.

Now that the Forest Museum, after costing so much thought, labour and money, is approaching within moderate distance of completion—so far at least as is contemplated by our modest scheme—it seems rather ungracious, not to say ungrateful, to raise any doubt as to the fitness of the present building for the purposes of a Natural History Museum. And yet such a doubt can hardly be repressed by any unprejudiced visitor. No one will deny that the building is much too small, and that the illumination in parts is sadly defective. Even with the addition of the new glass cases suggested in our scheme, there will be provision for only a very inadequate representation of the fauna and flora of the Forest. Mr. E. N. Buxton has very wisely raised his voice against over-crowding the Rooms. No one but a naturalist has any notion of the prodigality of life in the Forest district, and even the naturalist has probably but very imperfect ideas on such a subject. It is related that a certain professor once projected the formation of a Museum to be confined to the natural objects collected in the Gardens of Lincoln's Inn; but after a while he found himself compelled to abandon his scheme in consequence of the great number and variety of objects which the locality yielded.⁽⁹⁾ If Lincoln's Inn Fields are so rich, what must the Forest be? The district which we desire to illustrate in the Museum is indeed much too prolific to be adequately represented in our present restricted quarters.

Nor is the illumination everywhere sufficient, except on very bright days, to enable the visitor to inspect the specimens with satisfaction. It is true that many natural objects suffer from exposure to light, but the Curator can always shut out light, or moderate it, by means of blinds, whilst he can hardly ever admit more natural light than the architect has permitted. It is therefore, in my opinion, a matter of prime importance that every Museum should be so constructed as to allow a free flood of light into the exhibition galleries. Some people possibly may think otherwise, and prefer a dull and dreary place. One of the most curious remarks I ever met with in connection

(9) *Hints on the Formation of Local Museums.* By the Treasurer of the Wimbledon Museum Committee, London, 1863, p. 20.

with Museums was that of a writer who, otherwise uttering much common sense, held that "the drowsy appearance of a Museum peculiarly adapts it to the requirements of students."⁽¹⁰⁾

If I might be bold enough to throw out a hint as to what I should like to see in the Forest Museum of the future, I would venture to say that in my opinion the present building, with its interesting associations, should be used as a small antiquarian Museum and that the Natural History collections should be removed to a neighbouring building to be specially erected for their reception—a building which may be severely simple in architecture, but which shall be spacious and light.

The exhibits at present at Chingford may be regarded, for convenience, as falling into two groups—one scientific, the other archæological; though I do not for a moment intend to suggest by this conventional arrangement that archæology is not to be treated on scientific principles. The display of scientific objects in an ancient building always strikes me as rather incongruous, whereas objects of archæological interest readily harmonize with their antique surroundings. If I may dare to introduce just one word of criticism respecting another museum in Essex, I would refer to that at Colchester. There the archæological treasures, which everyone knows are of surpassing interest and inestimable value, including the famous Joslin and Jarmin collections, may not be considered altogether out of keeping with the venerable castle in which they are housed, but the small Natural History collection in the same building seems to me quite out of place in such an edifice.

Queen Elizabeth's Hunting Lodge, the present home of the Epping Forest Museum, is an example of early Tudor architecture, which itself forms a fine specimen for an "Open Air Museum." By the restoration of this building, the Corporation of the City of London has earned the gratitude of every lover of antiquity. It seems to me that the ideal way of utilising the old building would be to furnish it with appropriate objects of corresponding age, so that the whole might form a grand historical object-lesson. But as such an ideal is never likely to be reached, the next best thing is to use the building for the

(10) *Principles which should govern the classification and arrangement of Public Museums.* By Henrie O'Hara. Dublin: 1862, p. 3.

exhibition of a wider archæological collection of local character. The fittings should harmonize with the antique aspect of the rooms, and the contents of the cases should carry the visitor back, in imagination, to the distant past. All the antiquarian objects now on exhibition might remain in their present home—the relics from the Camps and the Chigwell Settlement, the stone and bronze implements, the old fire-producing appliances, the tapestries, the pictures, and the engravings of local interest. But all the natural history objects should, in my opinion, be transferred to new quarters—spacious, airy, and bright—where they would be more attractive and of greater educative value than in their present rather unsuitable location.

That the Forest Museum, even in its present state, is widely appreciated, let the thousands who throng it every season testify. But notwithstanding the crowds which pass through the rooms, a large proportion being children, scarce a single instance is known in which any damage has been wilfully done. This is the more remarkable, considering what a large surface of glass is exposed; moreover, there are many specimens under glass shades, accessible on shelves in the room, yet it is the rarest thing for these or the small glass vivaria to get injured.

To the schools which so often visit the Forest the museum is a source not only of great attraction, but in many cases of permanent profit. Children are quick to observe and ready to remember, full of curiosity and usually interested in a remarkable degree in living things, such as will be seen in the aquaria and vivaria in the museum. So again, to the young naturalist visiting the Forest, this museum is a feature of exceptional interest, for here he may hope to identify the spoils which he has secured in his rambles. Special attention should therefore be given to the exhibition of common things. The resorts of the London naturalist are unfortunately but few, and are getting fewer every year, but we rejoice that the Forest, which is one of the most favoured haunts, is preserved for ever from the defilement of bricks and mortar. May it have eventually a museum which shall be worthy of its reputation!

Five years after the Epping Forest Museum had been opened another Museum under the care of our Club, of wider scope than that at Chingford, inasmuch as it represents the whole county of Essex, was formally opened at Stratford by the Countess of

Warwick.¹¹ As the history of this Museum has been written by Mr. W. Cole in one of our little "Handbooks" I am relieved of the necessity of entering into historical details.¹² It is not without interest, however, on the occasion of this—our twenty-fifth—annual meeting, to recall the fact that the idea of forming a museum was entertained by those who founded the Club, and was distinctly explained by our first President, Prof. Meldola, in his inaugural address. There is probably no member of our Club ignorant of the way in which that idea, though long in abeyance, was ultimately carried out through the enlightened policy of the Corporation of West Ham, associated with the munificence of Mr. Passmore Edwards.

On entering the Passmore Edwards Museum, anyone familiar with the details of museum work will be struck with the admirable way in which modern ideas have been carried out. It is not a museum run on old lines, like many of those which are themselves qualified to be preserved in a larger museum as interesting, but rather melancholy, records of obsolete science. True it is but a small museum, yet it is arranged in harmony with the state of knowledge in the twentieth century. In a discussion on "The Museum Question" a few years ago in Liverpool, Prof. Herdman, one of our most distinguished naturalists, condemned the usual methods of exhibiting natural history objects as suggestive of the days of Linnæus, rather than of present day biology.¹³ At Stratford, however, he would find, I venture to think, little or nothing of an antiquated character. Mr. Cole has taken care that the biological clock should not be put back to the time of Linnæus. Let the visitor turn to the left as he enters the building, and he finds himself at once in a recess surrounded by cases which contain beautiful illustrations of the leading *Principles of Bionomics*. Here are several well-chosen series of specimens, chiefly insects, illustrating such subjects as protective and aggressive resemblance for concealment by colour and form; protection by warning colours; mimicry, or imitation of protected animals; and dimorphism or differences relating to season and sex. In a yet more prominent position in the body of the hall is a wall-case devoted to specimens,

¹¹ ESSEX NATURALIST, Vol. xi. (1901), p. 319.

¹² *The Essex Museum of Natural History*. By W. Cole, F.L.S., *Museum Handbook*, No. 3, 1900.

¹³ "The Museum Question." Report of Liverpool Geological Society, Vol. ix. (1901), p. xlvii.

principally casts, illustrating the famous case of the Ancestry of the Horse.

To all these collections which bear on natural evolution great value is imparted by the long descriptive labels, which have been drawn up by Mr. W. Cole. Not only here but all over the museum there are large labels and tablets, admirably composed, which make the collections self-interpreting, and offer to the visitor, who cares to read them, an excellent epitome of information on many branches of natural history. It is probable that by the casual visitor as he hurries through the museum they are unread and unheeded. Even the student who lingers over them may have but a faint notion of the labour involved in their composition. To put a scientific statement concisely yet clearly and in popular language is a task, the difficulty of which is known only to those who have had to face it. The labels in our museum are neat and legible, being either printed or type-written, whilst they appeal by their simplicity of expression to that unscientific individual, our familiar friend, who passes nowadays as the "man in the street." An American has said that our labels ought to be clear enough to "attract the newsboy and the boot-black."¹⁴ I hardly think our critic would find much fault in this respect at Stratford.

The prime object of the Essex Museum is, of course, to illustrate the natural history of the county. The greater part of the *Invertebrata* are represented by a large and valuable collection of shells, crustacea, insects and other objects which are, or will be, preserved in two mahogany cabinets that have recently been placed in the museum. These beautiful cabinets contain upwards of 100 glass-topped drawers, each having a stop at the back so that it may be partially drawn out by the visitor, and its contents inspected without fear of damage. In this way the specimens will be preserved from deterioration by exposure to light, and yet remain freely accessible to the public.

Notwithstanding the efforts of the curator there are still many gaps in the local collection, and members of the Essex Field Club may be reminded that they have it in their power to render the museum very material aid by contributing from the spoils which they collect. Addressing the members of the

¹⁴ Mr. Harlan J. Smith on "Popular Museum Exhibits." Museums Association Report of Oxford Meeting. 1897. p. 65.

Woolhope and Cotteswold Clubs many years ago, the late Prof. John Phillips said, "I would urge all persons belonging to field clubs, not selfishly to retain the specimens they gather, but to deposit them where they may be of use to their fellow-explorers."¹⁴ Such advice may be repeated with advantage to-day. Most members would, no doubt, be willing, if solicited, to share their captures with the museum, but they are probably not aware that such objects would be valued. Good examples of common things systematically collected are, however, much needed in many museums. It is a great encouragement to a young collector, who is not likely to secure rarities, to come to this museum and be able to identify the common species which he has collected.

By preserving the bulk of the local collection in cabinets much space is gained in the exposed table-cases for the exhibition of more attractive specimens not of local origin. While the prime function of the Museum is to illustrate the natural history of Essex, it has always been very properly regarded as a desirable object of the Club to render the collection of wide and even general educational value. Mr. W. Cole, in a suggestive paper, read seven years ago before the South-Eastern Union of Scientific Societies,¹⁵ emphasized this idea, and advocated the formation, even in a small local museum, of what is often called a "type or index collection." As long as a student limits his studies to the products of a special area, he finds himself unable, in consequence of the serious gaps in every local collection, to take a general and systematic view of any organic group. My friend, Mr. H. M. Platnauer, the accomplished curator for so many years of the York Museum, has aptly remarked that "Teaching from a local collection was like teaching from a text-book from which whole chapters and many pages have been torn."¹⁶ A visitor would form, in truth, but a poor idea of the group of the marine mollusca, for example, if he limited his attention to the shells of the Essex coast; but by the exhibition of a few typical shells from tropical seas, he gets a glimpse of the beauty and wealth of nature's resources in this department. Hence the table-cases in the Stratford Museum contain an

¹⁴ "On the Geology of the Malvern Hills."

¹⁵ "The Objects and Methods of a Local Museum." *Trans. South-Eastern Union Sci. Soc.* for 1897, p. 17.

¹⁶ *The Museums Journal*, vol. II. (1902), p. 54.

attractive and instructive collection of mollusca, crustacea, and insects from all parts of the world.

The very effective manner in which this collection is displayed ought not to pass unnoticed. The molluscan shells, for instance, are placed on cotton wool in trays, whilst the crustaceans are mounted on a sand-like floor; nothing, too, can be more clear and striking than the labelling—white letters being used on a black ground with a vermilion border. Let it not be thought that such details are too trivial for mention at a scientific meeting; on the contrary they are matters of the first moment in rendering the collection attractive to visitors; and it is neglect of such small matters that has done much to bring museums into ill repute.

Whilst referring to the excellent manner in which the specimens throughout the Museum are mounted, I should ill discharge my duty if I made no mention of the labours of Mr. Whitehead, Mr. Cole's assistant, to whose skill and taste in displaying the specimens the Museum owes much of its attractiveness; nor should I omit reference to his wide range of knowledge and scientific enthusiasm, which render his services of such great value to the Institution.

Part of the Invertebrate Collection is exhibited on the walls of the staircase leading from the ground floor of the Museum to the Gallery. Here will be found representatives of the great groups of *Calenterata*, *Porifera*, *Echinodermata* and *Vermes*, mostly preserved in spirit. Even the fugacious jelly-fish from Southend is represented here. Nothing can be more effective than the manner in which the soft organisms are mounted on sheets of glass, with a suitable dark background, in rectangular glass jars. In fact, the use of the parallel-sided jar instead of a cylinder, and the employment of formalin as a preservative agent, have been the means, in recent years, of displaying such objects in a manner which contrasts most favourably with the unsatisfactory methods of exhibiting "spirit specimens" in old-fashioned museums.

The lower *Vertebrata* are represented by an excellent collection of local *Fishes*, beautifully arranged in the alcove on the right hand of the visitor as he enters the museum. Here are numerous specimens, some stuffed and others preserved in spirit, illustrating the fish-fauna, not only of the freshwaters of Essex, but also of the shallow part of the North Sea which washes the

coast of our county. A chart shows the physical conditions of the North Sea, whilst a large series of coloured plates, from Couch's work, serves further to illustrate the local ichthyology. Let the anglers in the Essex rivers never forget that certain freshwater fishes are still wanted to complete the collection ; and, I believe, that some of the less common marine species are also needed.

In a glass case on the left of the entrance an attempt is made to illustrate the *Amphibians* and *Reptiles* of Essex. A fairly complete set of the *Mammals* of Essex, with skulls and skeletons of many species, is at present placed in the Small Hall, near the Curator's Room. The *Birds* of Essex are represented by a series of stuffed specimens in the glass cases which run round the walls of the museum, whilst these birds are associated in many cases with their nests and eggs, forming groups which offer an interesting insight into local bird-life. Many of the ornithological specimens are due to the generosity of Dr. Laver, of Colchester, who has also presented valuable collections of local lepidoptera and land and fresh-water shells.

It is the intention of the Curator to collect a series of specimens of local interest, in illustration of *Economic Zoology*, including especially the Mollusca and Crustacea which come into London from the estuary of the Thames and other parts of the Essex coast. Such a collection would do much to excite an interest in familiar objects, and might be useful as serving to show the visitor that science does not stand aloof from the incidents of daily life.

In the Small Hall, to which reference has been made above, there is now exhibited a small collection of *Prehistoric and other Antiquities*, including many objects of local interest, especially the relics from the Dene-holes, the Red Hills, and the settlement at Braintree. Further reference to these is rendered unnecessary, however, by the excellent descriptions in the little handbook by Mr. F. W. Reader.¹⁷ Although scarcely coming within the scope of a museum mainly devoted to natural history, I should like to see our museum possess a *Technological Department*, in which the industries of Essex should be illustrated, especially those which are extinct or tending to extinction.

¹⁷ *A Handbook to the Collection of Prehistoric Objects in the Essex Museum of Natural History.* By F. W. Reader.

A part only of the Gallery of the museum is at present given up to the natural history collections, but as these are rapidly increasing it is hoped that additional space may be secured in this section of the building, where the illumination by means of a direct top-light is well adapted for the display of objects requiring close inspection. The *Botanical collection* is located in the gallery. During the season fresh cut flowers are here exhibited week by week, as at the Forest Museum ; and the visitor is introduced to them by means of tablets adorned with charming little coloured sketches by Mr. Henry Cole. Here, too, are the *Mineralogical* and *Petrological* collections in course of arrangement by the skilful hands of Mr. Thomas W. Reader ; and here, likewise, is the collection of *Fossils*—a collection containing many choice specimens, due chiefly to the generosity of Dr. Horace T. Brown, Mr. W. H. Dalton, and Mr. Carvalho. As an introduction to this section of the museum there is a most instructive series of specimens illustrating the phenomena of fossilization, and intended to answer the question which is asked by a bold tablet at the head of the case : “ What is a fossil ? ”

In dealing with fossils a Curator is at once faced with the vexed question whether they should be arranged independently as a palæontological collection, or be associated with the zoological and botanical specimens as one series—the extinct and the extant forms taking their place in juxtaposition. A fossil may in fact be viewed in two aspects: as a “ medal of creation ” it has an obverse and a reverse. The biologist looks at one side, the geologist at the other. To the biologist the fossil is a link in the chain of life, connected with other links on its two sides—a unit in a long organic concatenation related to certain antecedents and to certain successors. But the geologist, whilst fully appreciating this philosophical aspect, views the fossil as an index to a certain set of strata, as a representative of life at a particular period of the earth's history.

After all, this question, whether a Curator should arrange his fossils on the biological or on the geological system, seems rather like the old question, “ Whether the tailor should make coats or trousers.” To which the very obvious retort was, “ Why not make both ? ” If the museum is extensive enough, there can surely be no valid reason why the two systems should not be followed. The Curator, realizing this, will do his best to satisfy at once the student of Life and the student of Time.

Even in the Essex Museum, though far from being large, an attempt has been made in a small way to carry out this dual scheme. A case stands, for example, in the Hall, containing both living and fossil forms of the Cephalopoda. Several fossil Nautili are here placed by side of the recent Pearly Nautilus; and some typical Ammonites are to be found close by; whilst a group of Belemnites keeps company with spirit preparations of the calamaries and the cuttle-fishes of the Essex coast. In the Gallery, again, will be found a very instructive case of certain extinct animals associated with their living representatives.

But whilst these series are arranged to illustrate in some measure the biological side of Palæontology, the bulk of the fossils will be found arranged, as is usual elsewhere, on a chronological system. By disposing them in stratigraphical sequence, the student gets a notion of the fauna and to some extent of the flora at successive periods of geological history. To Mr. W. H. Dalton the Club is much indebted for having expended a great deal of labour on the arrangement of the Fossils, and especially for writing a Handbook¹⁸ descriptive of the Pliocene fossils which have rendered East Anglia geologically famous, and of which, notwithstanding the ravishes of denudation to which Mr. Spiller has lately called attention, Essex can still boast a characteristic example in those shelly sands of Walton-on-the-Naze, which are believed to represent the oldest part of the Red Crag.

From this rapid survey of the contents of the Essex Museum and their arrangement, it will be seen how admirably the objects for which the Museum was originally organized have been so far carried out. The division into a Local and a General Collection is well defined. This division is in harmony with the views of most of those who have given thought to the Museum question. Mr. John Hopkinson, for instance, in suggesting to the Hertfordshire Natural History Society many years ago a scheme for the formation of a County Museum, insisted on the importance of dividing every Provincial Museum into two parts—one representative of a definite district, generally a county, and the other an educational department with a typical collection chiefly for the purpose of teaching.¹⁹

¹⁸ *A brief sketch of the Crag Formation of East Anglia.* By W. H. Dalton, F.G.S., Essex Field Club, Museum Handbooks, No. 4, 1900.

¹⁹ "The Formation and Arrangement of Provincial Museums," *Trans. Herts. Nat. Hist. Soc.*, Vol. i. (1881), p. 193.

The late Sir Wm. Flower, whose life was devoted to the highest type of museum work, pointed out, in his famous British Association address, that a museum should have a two-fold object—Research and Instruction.²⁰ The part devoted to research would be consulted only by those favoured few who had ability and opportunity for enlarging the bounds of knowledge, and consequently this portion need not be exhibited, but should be reserved for secluded study by the specialist. Such an arrangement is, perhaps, hardly applicable to a small museum like ours at Stratford; yet even there we are following, to some extent, the lines indicated, inasmuch as specimens prominently displayed to the public are such as should attract the general visitor, whilst the local collection for consultation by the serious student is preserved in cabinets, though those are accessible to all.

My friend, Dr. Bather, in a valuable address delivered a short time ago to the Museums Association at Aberdeen, took a wider view of museum organisation, and held that a typical museum has three functions—Investigation, Instruction and Inspiration.²¹ As an aid to investigation the Museum is consulted by the specialist who is occupied in original research; as a means of instruction it is used by the ordinary student, the amateur and the collector; as an aid to inspiration it appeals to the lay public, the rank outsider, the man in the street. Our Essex Museum, though appealing to the ordinary student, is largely concerned with the last of these functions—it seeks to attract and elevate the general public of West Ham. Our purpose, to borrow Dr. Bather's words, is "not to turn every member of the gaping crowd into a doctor of science, but to awaken their imagination and interest, and to give to a street-bred folk some feeling for the nature it has well-nigh forgotten. The love of nature is the essential thing; the questioning of her will follow."

It may, perhaps, be said that theoretically we need three museums, one for each type of visitor—the specialist, the student and the stranger. The first and the second type of museum may be united, so may the second and third, but the first and third types are generally as little disposed to union as oil and water.

²⁰ *Rep. Brit. Assoc.* Newcastle-on-Tyne, 1889, reprinted in *Essays on Museums*. London: 1898, p. 1.

²¹ *Rep. Mus. Assoc.* Aberdeen meeting, 1903. See also his paper on "The Functions of Museums," in the *Popular Science Monthly*, Jan., 1904, p. 210.

All we can hope to do in our small museum is to appeal to the student and the stranger; whilst the specialist, bent on original research, will naturally turn to more important institutions, generally to the British Museum.

Considering the magnitude and importance of our National Museum—the pride of British science—it seems amazing that its existence goes no further back than some hundred and fifty years. It was first opened to the public at Montague House, on January 15th, 1759, only, however, for three hours a day; and indeed for long afterwards the admission was restricted by complicated regulations, which were no doubt considered necessary at the time but which seem to us, looking back from these days of freedom, to have been of a most vexatious character.²²

The original nucleus of the British museum, around which the magnificent national collections have aggregated in the course of a century and a half, was the private museum of Sir Hans Sloane. Sloane—the intimate friend of Boyle and Ray, and the immediate successor of Newton in the Presidential chair of the Royal Society—had not only made a great collection himself, begun in early life during his sojourn in the West Indies, but he succeeded in 1701 to the valuable collections of his friend William Courteen. In 1684, Courteen, who had lived much on the continent, opened a suite of rooms in the Temple, and there arranged his collections, on which he had spent the greater part of his fortune, and which he valued at £50,000. Yet the sum paid by the nation in 1753 for the Sloane museum at Chelsea, including Courteen's specimens, was but £20,000—a sum which, according to a codicil to Sloane's will, was not a quarter of their intrinsic value. The Act of Parliament which was passed for the purchase of the Sloane collection and the Harleian manuscripts was also directed to “providing one general repository for the better reception and more convenient use for the said collection.” Such was the origin of the British museum. It is this repository which has gradually expanded into the splendid institutions at Bloomsbury and South Kensington.

²² Walter Harrison in his “History” gives the following description of the mode of gaining admittance to the Museum:—

“If any number, not exceeding fifteen, are inclined to see it, they must send a list of their christian and surnames, with their place of abode, to the porter's lodge, in order to their being entered in the book; in a few days the respective tickets will be made out, specifying the day and hour when they are to come; which, on being sent for, will be delivered. The fewer names there are on the list, the sooner the company will gain admittance.”

Previously to the foundation of the British museum, the great museum in London was that of the Royal Society. The formation of a Museum has generally been considered to be legitimately included in the work of any society devoted to the advancement of science; and the Essex Field Club has consequently been simply a humble follower in this direction. Bishop Sprat, in describing the early doings of the founders of the Royal Society after the Oxford Meetings were broken up and they had settled in London, tells us that:—

“As soon as they were reduc'd into a *Fix'd Assembly*, one of the Principal Intentions they propos'd to accomplish, was a General Collection of all the *Effects of Arts*, and the Common, or Monstrous *Works of Nature*. This they at first began by the casual Presents, which either *Strangers*, or any of their own Members bestow'd upon them. And in short time it has increas'd so fast, by a contribution from all Parts, and chiefly by the bounty of Mr. *Colwall*, that they have already drawn together into one Room, the greatest part of all the several kinds of things, that are scatter'd throughout the *Universe* (!). The Keeping, and Ranging of these into order, is committed to Mr. *Hook*, who had also the honour of being made the first *Curator* of the *Royal Society* by election.”²³

Writing to Mr. Boyle on February 3, 1666, Hooke, the Secretary of the Royal Society, says “I am now making a collection of natural rarities, and hope within a short time to get as good as any that have yet been made in any part of the world.” About this time, the Council resolved “that the donation of £100, presented by Mr. Colwall, should be expended in purchasing the collection of rarities formerly belonging to Mr. Hubbard.”

Dr. David Murray in his recently published work on museums,²⁴ suggests with much plausibility that this “Mr. Hubbard” was really Robert Hubert *alias* Forges, who is known to have had a large collection of rarities, which he exhibited publicly in 1664 at “the place called the Musick House, at the Miter near the west end of St. Paul's Church.” Of this collection a catalogue exists, and many of the objects are

²³*The History of the Royal Society of London, for the improving of Natural Knowledge.* By Tho. Sprat, D.D., Lord Bishop of Rochester. London: 2nd ed. 1702. P. 251.

The “Curator” of the Royal Society was an officer who attended to the experiments, etc.

²⁴*Museums, their History and their Use.* By David Murray, LL.D., F.S.A. 3 vols. Glasgow. 1914.

It was not until after this Address had practically been finished that I had an opportunity of consulting this valuable work. Had I seen it earlier I should have used it more freely. In working up the history of the subject I was familiar with the chapter on “Collections of Natural Curiosities” in Beckmann's *History of Inventions*, and with Prof. Newton's paper and a few other short notes; but struck with the scarcity of information on the subject, I had said, in the draft of the address, “The history of museums has yet to be written.” Before the time came, however, to deliver the address Dr. Murray's comprehensive volume had made its appearance.

evidently those which afterwards figured in the Royal Society's Museum.

As soon as the Society thus acquired the nucleus of a collection, donations flowed in rapidly, including many objects of a rather curious character. Sir Robert Moray, for instance, presented "a bottle full of stag's tears"—reputed at that time to possess much medicinal value. We have not, I believe, yet procured for our Museum a similar specimen as a relic of the red deer of Epping Forest.

When Boyle died in 1691 it was found that he had bequeathed to the Society his mineral collection, or as he described it, "all my raw and unprepared minerals as ores, marchasites, earths, stones (excepting jewels), etc., to be kept among their collections of the like kind, as a testimony of my great respect for the illustrious Society."²¹

But before the time of the Boyle bequest the collections had grown so large that it was felt necessary to have a catalogue. Accordingly, at a meeting on July 18, 1678, it was ordered "That Dr. Grew be desired at his leasure (*sic*) to make a Catalogue and Description of the Rarities belonging to this Society." At that time the Repository, as it was called, contained, we are told, "several thousand specimens of zoological subjects and foreign curiosities." Nehemiah Grew, who was commissioned to compile the catalogue, was a very learned, versatile, and industrious man, especially distinguished for his researches in vegetable physiology. He seems to have completed his catalogue within a year, though it was not published until 1681, when it appeared as a folio of 388 pages, with an anatomical supplement of 43 pages. It was dedicated to Daniel Colwall, a wealthy citizen, described as Founder of the Museum, and his portrait forms the frontispiece.²²

The catalogue is in many places very quaint and amusing reading, and offers an insight into the state of natural history two centuries ago. In 1682 Grew was appointed to take charge of the Repository under the title of "Præfectus Musei Regalis Societatis," and he was requested to "make a short catalogue of

²¹ The quotations are from *A History of the Royal Society*. By Charles Richard Wall. London: 1845.

²² *Museum Regalis Societatis, or a Catalogue and Description of the Natural and Artificial Rarities belonging to the Royal Society, and preserved at Gresham College. Made by Nehemiah Grew, M.D. Whereunto is Subjoined the Compendious Anatomy of Stomachs and Guts. By the same Author.* London: 1681.

the Rarities, with a method for the ready finding them out." They were indeed a very miscellaneous collection, including, according to the catalogue, not only all kinds of animals, plants, and minerals, but also metals and chemical products, physical apparatus and models, coins and various antiquities, ethnological objects, and curios in general. In fact, so august a body as the Royal Society seems in those days to have regarded a museum much as Horace Walpole regarded it at a later date, as "A hospital for everything that is singular."

When the Government granted rooms to the Society no space was provided for the museum, and consequently on removal from Gresham College the collections were presented to the newly-established British Museum. The Royal Society's Museum, after a life of rather more than a century, ceased to exist as such in the year 1779.

I am not ambitious enough in this address to attempt to trace, even in the barest outline, the general history of museums. Where was the first museum, and who was its curator, are questions which no man is ever likely to answer. Reference has often been made to the collections of Aristotle and other naturalists of classical antiquity, and to the treasures of Solomon and Hezekiah; whilst some writers have even been bold enough to suggest that prehistoric man was not without his little Museum. Forty years ago M. Dupont discovered in a limestone cavern on the bank of the river Lasse, in Belgium, a collection of fossil shells, including the gigantic *Cerithium*, which must have been brought a distance of 40 or 50 miles, with a piece of fluor-spar, and various other objects. Possibly they were brought together as mysterious objects for worship, or perhaps only as personal decorations; but the late Mr. G. H. Morton, of Liverpool, thought it more likely that they were collected as mere curiosities—prehistoric curios.²⁵

As practical people, however, it is more to our present purpose to utilize the brief time at our disposal in dealing with the museums of our own country, in comparatively modern times.

At the time the Royal Society founded its Museum, the only collection of importance in this country seems to have been that

²⁵ "Museums of the Past, the Present, and the Future." *Proc. Liverpool Nat. Field Club* for 1893.

of the Tradescants.²⁶ John Tradescant, the elder, who travelled as a botanist, and was gardener to Queen Henrietta Maria, is described by an old writer as "a painful industrious searcher, and lover of all Nature's varieties," but his tastes were not confined to natural history, and the museum which he formed at Lambeth became an *omnium gatherum*. The collections were augmented by his son John Tradescant, who in 1656 published a catalogue of his "Rarities," which he described as being "more for variety than any one place known in Europe could afford."²⁷ The museum, known as "Tradescant's Ark," became one of the curiosities of the age—"a world of wonders in one closet shut." Prof. Newton, of Cambridge, has referred to the two Tradescants as "the parents of British Musæology,"²⁸ and as such they command our profound homage.

It appears that the second Tradescant made over his "Closet of Curiosities" by deed of gift, in 1659, to his friend Elias Ashmole, but by a will of later date bequeathed the collection to his wife, for her life. This led, unfortunately, but not unnaturally, to litigation. After a while, however, the museum passed to Ashmole, whose name it afterwards bore.

Ashmole, who thus became possessed of the extensive collections of the Tradescants, was a learned man of versatile tastes, leaning especially towards heraldry, astrology, and alchemy. A liking for botany seems to have attracted him to Tradescant, with whom at one time he lodged. On acquiring the "Ark," he built for its reception a house in South Lambeth, adjoining that previously occupied by Tradescant. After retaining the collection for some years, and much enriching it, he offered to present it to the University of Oxford, provided that a suitable building were erected for its reception. This condition having been accepted, the "Ashmolean Museum" was built from plans, said to be by Sir Christopher Wren; and in 1682, twenty years after the death of the younger Tradescant, the collection was removed in twelve wagons from Lambeth to Oxford. Dr. Plot, the historian of Oxfordshire and Staffordshire, became the first curator. In an old essay on the "History of Museums," read before the

26 Excellent biographies of the Tradescants, by Prof. G. S. Boulger, will be found in the *Dictionary of National Biography*.

27 *Museum Tradescantianum; or a Collection of Rarities preserved at South Lambeth, near (sic) London.* By John Tradescant. London: 1656.

28 "Notes on some old Museums." By Alfred Newton, M.A., V.P.R.S. *Rep. Museums Assoc.*, Cambridge Meeting, 1891, p. 32.

Ashmolean Society, the author says "It is agreed on by all our antiquaries that the Tradescant collection, which was the foundation of the Ashmolean Museum, was the earliest exhibited in Britain."²⁹

On the Continent, however, there were collections of no mean importance a hundred years earlier. A printed catalogue exists, for instance, of the Kentmann Cabinet, dated 1565. Johann Kentmann was a physician, who lived at one time at Torgau in Saxony, and afterwards at Dresden. The doctor had collected about 1,600 specimens, chiefly minerals and fossils, with a few shells, corals, and other marine objects, and preserved his collection in an ark, or cabinet, of 13 double drawers, figured in the catalogue. This catalogue was published by the doctor's good friend Gesner, in a volume which contains also a number of scientific essays, including a treatise on precious stones and other minerals.³⁰

Courad Gesner, who has been styled "The German Pliny," seems to have been one of the most remarkable men the world has ever seen. At one time he was professor of the Greek language, at another time professor of medicine, and again we hear of his holding a chair of philosophy. His industry was prodigious, for though he died before he was fifty years of age (*b.* 1516, *d.* 1565) he left a vast number of works relating to most diverse subjects. Every branch of natural history secured his sympathy, and he formed a collection much larger and more important than Kentmann's, though I am not aware that a catalogue of it is included in his writings. To accommodate this collection he built at Zurich a Museum surrounded by a botanic garden. It is related that knowing his end was approaching he had a couch placed in his Museum and was carried thither, so that he might expire in the midst of those objects to which he was so devoted. It is with good reason that Gesner has been called the "Father of Natural History Museums."³¹ His collection passed, on his death, to his friend Felix Plater, a doctor in Basle,³² who possessed a notable collection.

²⁹ *A Catalogue of the Ashmolean Museum.* Oxford: 1836.

³⁰ *De Omni Rerum Fossilium Genera, Gemmis, Lapidibus, Metallis et hujusmodi, Libri aliquot, plurique nunc primum editi. Opera Conradi Gesneri.* Tiguri: MDLXV.

³¹ Presidential Address by Rev. Henry H Higgins, M.A. *Report Museums Assoc.*, Liverpool Meeting, 1890.

³² *Conrad Gesner: Ein Beytrag zur Geschichte des Wissenschaftlichen Strebens und der Glaubensverbesserung im 16 ten Jahrhundert.* By Johannes Hanhart. Winterthur: 1824. p. 270.

Our illustrious countryman, Ray, in passing through Basle, visited Plater's Museum, which he describes as "a good collection of minerals, stones, metals, dried fishes, and other natural and artificial rarities," and he goes on to say that these were "disposed in a good method, the names being set to each one."³³ Plater had evidently the methodical instinct of the true curator.

Gesner's museum carries us back at least 350 years, but we might pursue the history of museums to a much more remote period, for we know that there were collections of natural objects occasionally made by men in advance of their generation. To us, however, it is more interesting to note the character of the museums which satisfied the wants of our forefathers in less remote times.

During the eighteenth century, and even later, there were several proprietary museums opened in London and elsewhere as shows. Probably the most famous was that of Sir Ashton Lever. Born at Alkington, near Manchester, in 1729, he developed in early life a great taste for collecting, and being possessed of ample means, acquired a large collection. This he removed, in 1774, from Alkington Hall to London, and he then exhibited it at Leicester House, in Leicester Square. He styled his exhibition the "Holophysikon," and charged each visitor 5s. 3d. for admission. Having spent a very large sum on his museum his affairs became embarrassed and he offered his collection at a very moderate price to the trustees of the British Museum. By them, however, it was declined. Lever then obtained parliamentary power to dispose of it by lottery, the value officially put upon it being £53,000. At the lottery the prize fell to a certain James Parkinson, who had been a law-stationer and estate agent. He not unnaturally endeavoured to dispose of it, and seems to have entered into negotiations with people of importance, like the Queen of Portugal and the Empress of Russia; but these negotiations fell through, and as the rent of Leicester House was considerable he purchased a piece of ground in Albion Street, Southwark, in which he erected a building that came to be known as the Rotunda.³⁴ To this museum the admission was half-a-crown, and for some years

³³ "Travels through the Low Countries, Germany, Italy, and France." 2nd ed., 1738, p. 85.

³⁴ A view of the interior of the Museum is engraved as a frontispiece to the Catalogue, entitled *A Companion to the Museum (late Sir Ashton Lever's). Removed to Albion Street, the Surrey End of Black Friars Bridge.* London, 1790.

it flourished as one of the sights of London. An American naturalist, C. W. Poole, describing a visit to London in 1800, says :—" The trouble to obtain a sight of the British Museum renders it of less value to the public than a private collection belonging to Mr. Parkinson, called the Leverian Museum." Eventually, however, the popularity of this museum declined, and in 1806 it was sold by auction—the sale extending over 65 days, and including 7,819 lots. The Rotunda was afterwards used for some time as a scientific institution.

Another metropolitan museum, well known in the early part of the last century, was Bullock's Museum, which had the advantage over Lever's of a more central situation, and a smaller admission fee. William Bullock was originally a silversmith and jeweller in Lord Street, Liverpool, where he opened, in 1801, a Museum of Natural and Artificial Curiosities, which he described as " comprising upwards of 800 objects." The admission to this modest collection was 1s., or by an annual ticket costing 10s. 6d. After removing his collection to other premises in Liverpool, he brought it, in 1809, to London, and exhibited it at No. 22, Piccadilly, at first under the name of " the Liverpool Museum." By this time the original 800 specimens had increased to 7,000, described as " Natural and Foreign Curiosities, Antiquities, and Products of the Fine Arts," which had cost the owner £20,000. Its popularity was so great that Bullock was led to build for its reception the Egyptian Hall. This remarkable building, now about to be pulled down, was erected in 1812, from the designs of Mr. P. F. Robinson, at a cost of £30,000. When transferred to the " Egyptian Gallery " the collection became known as the " London Museum," and was described by the owner, in his guide book, as consisting of upwards of 15,000 specimens " collected during 20 years of unwearied application, and at an expense exceeding £30,000." Mr. Bullock refers to his museum as " an Establishment for the Advancement of the Science of Natural History, which in magnitude and expense, he presumes, is unparalleled as the work of an individual."³⁵

In 1819, Bullock's collection was brought to the hammer, the sale including 3,331 lots, extending over 26 days, and realizing about £12,000. After the sale, Bullock went to Mexico, and

³⁵ " A Companion to the London Museum and Pantheon, containing a brief description of upwards of 15,000 natural and foreign curiosities, antiquities, and productions of fine arts ; now open for public inspection at the Egyptian Temple, Piccadilly, London." By William Bullock.

formed large collections which he brought home and exhibited in the Egyptian Hall, in 1824, in the form of two exhibitions called "Ancient Mexico" and "Modern Mexico." From the guide-books which I possess to all his exhibitions it is clear that Bullock was a man of much enthusiasm for natural history and archæology.

Before the days of the large museums of Lever and Bullock, it was the custom to form small collections at houses of refreshment as an attraction to the customers. Of these, perhaps, the most famous was that in Cheyne Walk, Chelsea, opened in 1695 by the eccentric John Salter, known as "Don Saltero." He had been for many years in the service of Sir Hans Sloane, who had given him most of the specimens with which he started the museum that he called the "Chelsea Knackatory." Steele speaks of "ten thousand gimcracks round the room and on the ceiling." The miscellaneous assemblage of things included, however, a large number of natural-history objects. Faulkner, the historian of Chelsea, refers to "a great variety of petrifications, corals, chrystals, ores, shells, animals preserved in spirits, stuffed animals from various parts of the world, idols, curious Chinese manuscripts, missals, birds, snakes, butterflies, medals," etc. It is the custom to smile and sneer at these old miscellaneous collections, but Faulkner sympathetically remarks that they "cherished the infancy of science, and should not be depreciated now, as the playthings of a boy are scorned after he has arrived at manhood."³⁶

When Don Saltero's collection of curiosities was sold by auction in 1799, the total amount realized was but little over £50 !

The days of Salter's "auld knick-knackets" are over, but even at the present day collections of curiosities at public places of refreshment are not altogether unknown ; witness, for example, the museum of the Edinburgh Castle, in Camden Town, which has become quite famous for the eggs of the Great Auk.

Let us turn now to the county in which our Club is specially interested. Whether any antiquary has ever been able to ascertain when the first museum was formed in Essex, I know not. Probably here as elsewhere private collections have always been

³⁶ *An historical and topographical description of Chelsea and its Environs.* By Thomas Faulkner. London : 1829, vol. 1, p. 382.

made, more or less systematically by students of natural history, though such collections might never rise to the dignity of a museum. Our great Essex naturalist, John Ray, must surely have possessed a collection. His friend and benefactor, Francis Willughby, we know collected extensively and secured the advantage of Ray's curatorial assistance. In a letter to Martin Lister, dated June 18, 1667, Ray says: "The most part of the winter I spent in reviewing and helping to put in order Mr. Willughby's collection of birds, fishes, shells, stones, and other fossils; seeds, dried plants, coins, etc."³⁷

It is clear therefore that the Willughby collection was of a very comprehensive character. Ray, being a man of restricted means, could hardly indulge in a similar manner, however wide his sympathies may have been; but that he had some kind of collection is clear, for we are told that "whatever he had preserved relative to any branch of natural history he gave before his death to his neighbour, Mr. Samuel Dale."³⁸ The Ray collection therefore passed to his executor, and the herbarium was presented by him to the Physic Garden at Chelsea, but ultimately found an appropriate resting place in the British Museum.

One of the earliest, and still one of the best, natural history museums ever founded by a local society in this country is the museum at Saffron Walden. Soon after the foundation of a Natural History Society in that town, in 1832, it was resolved "that a museum be founded to include specimens in the several departments of natural history, with antiquarian remains and such other articles as might be of general or local interest." The collections were accommodated at first in the house of Mr. Jabez Gibson, who had been mainly instrumental in organizing the society, but in 1834 they were removed to the building specially erected for their reception by Lord Braybrooke. This museum was opened on May 12th, 1835.

That the special value of a local collection was recognized at that time is evident from a statement circulated before the building was opened, in which it was said that "the concentration of Specimens peculiar to the District in which the Museum is established will form a leading feature in its

³⁷ Dr. Derham's Life in *Memorials of John Ray*. Edited by Edwin Lankester. Ray Society: 1845, p. 17.

³⁸ Sir J. E. Smith in the Ray Society's volume, p. 85.

arrangement." At the same time the collections included specimens from widely distant parts of the world, and these of such exceptional interest in certain cases that the museum positively surpassed at that time the British Museum. The skeletons and skins of the African elephant and the two-horned rhinoceros were said to be the earliest ever known in this country; indeed, the specimen of the African elephant, stuffed by Mr. Joseph Clarke, was considered to be of such interest that it was sent to the Great Exhibition of 1851. Many of the larger mammals were due to the generosity of Mr. George Wombwell, the proprietor of the menagerie, who took, from his local association, great interest in the museum.

It is a notable proof of the intelligence and enterprise of the organisers of this museum that within ten years of its foundation they published an admirable catalogue.³⁹ Sixty years have slipped by since that work was issued, and during this time science has indeed made startling progress, yet it may be fairly said that the production of such a catalogue—so carefully compiled, admirably printed, and delicately illustrated—would be creditable to any provincial museum even at the present day. From the frontispiece we get an insight into an Essex Museum sixty years ago, and the view is one in which an Essex man may justly feel pride! We are not surprised that, according to Mr. Miller Christy, the catalogue "is said to have been the best of its kind in existence at that day."⁴⁰

Since the Saffron Walden Museum was founded, now seventy years ago, the museum movement, at that time scarcely recognised, has made marvellously rapid progress. In 1845, the year in which the Saffron Walden catalogue was published, an Act was passed by the Legislature, enabling certain municipal bodies to levy a rate for the establishment of museums of science and art. From this small beginning we have advanced, until at the present day most of our museums are under municipal authority, so that, unlike museums belonging to local societies they enjoy an income which though it may be small is yet officially assured. Without such support by the West Ham Corporation, where would be our Essex museum!

When we remember the difficulty of formerly obtaining access to the British Museum, when we remember too that to see

³⁹ *An Abridged Catalogue of the Saffron Walden Museum.* 1854.

⁴⁰ *The Birds of Essex.* Essex Field Club Special Memoirs, vol.ii., 1890.

the Leverian museum in Leicester Square the visitor had to pay at least five shillings, we ought indeed to congratulate ourselves that our lot is cast in such enlightened times that we have municipal museums freely scattered throughout our land, which may be visited by anyone without entrance fee or other hindrance. The museum has come to be recognised, in the words of Mr. E. Howarth, as "an essential element of municipal life."⁴¹ It is hardly too much to say that every free library should have associated with it a free museum. Indeed, many who have given much thought to the matter have been led to conclude that the museum is perhaps in some respects the more important of the two institutions. "Museums," said Professor Boyd Dawkins, "appeal to the interest of many, while books and a taste for books interest a narrower circle."⁴² Turning to the admirable speech delivered by the Countess of Warwick, at the opening of our Essex museum, we find the opinion expressed that "the foundation of a local museum for purposes of study and reference is as valuable—perhaps even more valuable—than a public library, for the drift of modern thought in the direction of scientific education is towards a knowledge of nature rather than a knowledge of books."⁴³ It is obvious that the young student learns more by direct relation with the concrete natural objects—the minerals, the plants, the animals—even if he merely sees them in glass-cases—than he can possibly learn about them by mere reading. An Amercian writer has remarked that "the near future may well see as great an interest in the establishment of museums as there is now in the founding of libraries."⁴⁴

The day has gone by when people could afford to sneer at local museums—"the little museums accumulated for the service of science by the philosophers of all our country towns."⁴⁵ It must be admitted that the old type of provincial museum founded by the enthusiasm of a few members of a local society usually left much to be desired. When the founders passed away, it often became difficult, sometimes impossible, to find successors who would carry on the work of the museum, and the collections were consequently doomed sooner or later to

⁴¹ *Report, Museums Association, Canterbury Meeting, 1900, p. 76.*

⁴² *Ibid.* Manchester Meeting, 1892.

⁴³ *ESSEX NATURALIST*, Vol. xi. (1900), p. 325.

⁴⁴ "The Opportunity of the Smaller Museums of Natural History."—*Popular Science Monthly*, May, 1903, p. 40.

⁴⁵ *A Second Letter to a Dissenter on the Opposition of the University of Oxford to the Charter of the London College.* By the Rev. W. Bewell, M.A., 1834.

fall a prey to neglect. Hence, there was little to induce the possessors of valuable objects to give them to the local museum. But all this is now changed. Public opinion to-day recognises that the care of the local museum is as much a part of the duty of the Corporation as the care of the public roads. "The one vital principle which surrounds Corporations," says Mr. Greenwood, "is that they are gifted with perpetual life."⁴⁶ Anyone therefore who gives a collection to a municipal museum feels that its care is permanently assured.

Since the Essex Field Club was founded, a quarter of a century ago, there has been a great advance in the popular appreciation of museums. An important step was taken in 1886, when the British Association appointed a committee to report upon the Provincial Museums of this country. The reports of this committee drawn up by the late Mr. F. J. Mott as Secretary, form a valuable repertory of information.

But a far more important step was taken by the formation, in 1889, of the Museums Association. Then, for the first time, the Curators throughout the country became organised. At the annual meetings of this Association the Curators and others interested in museums meet in conference, so that all matters of museum economy can be fully discussed by experts. Those who wish to know something about modern museums will find information of the most valuable character in the Annual Reports and in *The Museums Journal*, which is the organ of the association. Here the reader is made acquainted with the most recent methods of museum work, and will thus realise the admirable manner in which most of our provincial museums are becoming organised.

As an example of a museum which in spite of very restricted space, and with only moderate resources, may yet profit by the modern system of museum *technique*, we may point with some pride to our own museum at Stratford. Let it ever be remembered, however, that the maintenance of a museum, worthy of the present day, involves an immense amount of labour. It was a remark of the late Sir William Flower, that "a museum is like a living organism—it requires continual and tender care. It must grow or it will perish."⁴⁷ No words could be more just. However carefully a collection may be arranged, it will, if left to

⁴⁶ *Museums and Art Galleries*. By Thomas Greenwood, London 1898

⁴⁷ *Essays on Museums* p. 13.

itself, inevitably degenerate. The tender care of the Curator is needed incessantly. The Rev. H. H. Higgins, who was for so many years the enthusiastic honorary Curator of the Liverpool Museum, well said that "the Curator is the soul of the museum"—a sentiment endorsed by most authorities on museum organization. Yet how often does it happen that as we pass through a well-arranged museum we forget the Curator! The visitor seems usually to think that the specimens are able to shuffle about and arrange themselves in scientific order. But if in the midst of an orderly arrangement there should be some small part of the collection in an unsatisfactory condition, the Curator is then by no means forgotten. In accordance with the common tendency of human criticism, we are apt to overlook the bulk of the collection in all its fair aspect, and centre our attention on the disfiguring speck.

However devoted and however smart a Curator may be, he finds it impossible to make bricks without straw. In order that his museum may be in creditable condition, he needs all the neat appliances which are now in the market for mounting and displaying specimens; he needs the best books of reference for the identification of the objects which pass through his hands; he requires assistance at least to carry out such mechanical details as mounting and labelling. Above all, the cases and cabinets in the museum must be of the best construction, so as to protect their contents from dust and other sources of deterioration. If we have any regard for our collection, it will be found the worst possible policy to buy cheap cabinets. Taking all this into consideration, a museum is often denounced as an expensive fad. Never was there a greater mistake; it is not a fad, and considering its value to the community it is not expensive. "If you compare its cost with that of any other part of our educational machinery, I maintain," said Mr. Charles Madeley, "that it is exceedingly cheap."⁴⁸

Admitting the value of Museums, under certain conditions, objection has sometimes been taken to their multiplication. It has been held that in proportion as they become common they will cease to be impressive. We in London surely cannot want them. What need can there be to have small Museums in or near the metropolis, when we have the doors of the

⁴⁸ "District Museums." *Museum Journal*. vol. IV. (1904). p. 117.

National Museum always open in our very midst! Everything that we can hope to shew in a small museum, may certainly be found in the British Museum.

I have already referred, however, to the bewildering effect of large collections. There is no question that the wealth of specimens is apt to throw the untrained visitor into a state of mental distraction. Mr. Thomas Greenwood has observed that "there is such a condition of mind as picture drunkenness or Museum drunkenness."⁴⁹ Depend upon it a small collection encourages concentration of attention, whilst a large collection tempts to diffusion of thought. Just as every student knows "it is better to digest a chapter than to read a volume," so it is far better to see a small collection, and remember what it teaches, than to range aimlessly over a vast museum.

Many years ago when it was proposed to establish a local museum at Wimbledon, Mr. Joseph Toynbee delivered an excellent address in which he advanced the view that in a large town or city, each parish should have its own museum, exhibiting the objects collected within a radius of five miles from the parish."⁵⁰

No thoughtful person will despise a small museum, or object to such museums being multiplied, when he reflects on the utility of such humble institutions to the young people in their immediate neighbourhood. If any one desires to see what may be done with small means, let him visit the little museums at Stepney under the care of Miss Kate Hall.⁵¹ This enthusiastic lady, by her admirable demonstrations, has made her museums living centres of light and learning to the children of the East End.

The subject of demonstrations is one of great importance in viewing museums from an educational standpoint. Many persons fail to feel interest in a visit to a museum merely because they have no one to direct them and offer simple explanations of what they see. A party of visitors will often sigh for some "museum Cook," who could personally conduct them round the institution. Such conduct, however, needs to be in capable hands. In the early days of the British Museum it was the custom for the attendants to take the visitors, in small parties,

⁴⁹ *Museums and Art Galleries*, p. 29.

⁵⁰ "Hints on the Formation of Local Museums." p. 21.

⁵¹ See her paper, "The Smallest Museum," *The Museums Journal*, vol. i. (1902), p. 38

from room to room; but the practice does not appear to have been always satisfactory. At any rate a visitor in the beginning of the last century, was led to complain that the conductor treated the company to "witticisms on various subjects of natural history, in a style of vulgarity and impudence, which I should not have expected to have met in this place."⁵²

Formal demonstrations in a museum are generally attended with more difficulty than most people imagine; and after much experience, both as a listener and as a demonstrator, I was led some years ago to suggest that the formal demonstration, or lecture, should be given in a neighbouring room rather than in the midst of the cases.⁵³ It is gratifying to find that at the Essex Museum arrangements are now being made, whereby a convenient room, with electric lantern and screen, will be placed at the disposal of those who desire to give demonstrations in illustration of the contents of the museum.

In a paper on the utilization of local museums read at the last meeting of the British Association, the Rev. W. Johnson, of York, described the excellent work of Mr. Crowther, the Curator in Leeds, in lecturing to the schools, which systematically visit the museum; and considering the great value of such work he strongly advocated its extension, with payment by the local authorities for the additional labour thus thrown upon the Curator. "This work," said Mr. Johnson, "is at any rate as well worthy of this support as are free libraries, or municipal bands, or art-galleries."⁵⁴

Apart from formal lectures and demonstrations, a visitor to a Museum would often be glad of a description of some particular object, or group of specimens, of exceptional interest, and would be quite willing to pay a small fee for such a description by some competent person. Prof. Anton Fritsch, of Prague, has playfully suggested that the day may come when a visitor, standing in front of some interesting specimen, will have simply to drop a coin into a slot connected with a phonograph, and forthwith he will hear a short discourse on the specimen in the very words, nay, even the very voice, of some

⁵² *Journal of a Tour and Residence in Great Britain, in the years 1810-1811.*
By Louis Simond. 1815. vol. i., p. 84.

⁵³ "On the difficulties incidental to Museum Demonstrations." *Report Museum Association*, Cambridge Meeting, 1891, p. 71.

⁵⁴ *Report British Association*, Cambridge Meeting, 1904.

distinguished professor."⁵⁵ Many a true word is proverbially spoken in jest, and, in conclusion, I commend this idea to our Curator, who happens to be much interested in talking machines. We already have in the Essex Museum, for the use of the public, a microscope and a spinthariscopes. Why not a phonograph?

In now relinquishing the honourable position to which your suffrages kindly, and quite undeservedly, called me two years ago, I am anxious to express my deep sense of obligation to the officers, the Council, and the members generally—but especially to the Honorary Secretaries—for the generous assistance and loyalty which they have uniformly rendered to me, and for the courteous indulgence which they have extended to me, during my occupation of the presidential chair. The pleasure with which I shall look back upon my tenure of this position will be greatly enhanced by the feeling that I am succeeded by one so much more worthy in every way to conduct the affairs of this important organization. In Mr. Miller Christy, the Essex Field Club has at once a local naturalist, who has made his mark by a standard work on the Birds of Essex, and an antiquary who is an acknowledged authority on many branches of county history—one who has always been zealous in his support of this Club in the past; one who will, I feel sure, be yet more zealous for its welfare in the future.

⁵⁵ "The Museum Question in Europe and America." *The Museums Journal*, vol. iii. (1904), p. 248.

THE BRITISH WOODLICE.

By WILFRED MARK WEBB, F.L.S., and CHARLES SILLEM.

(With Plates I.—XXV., and numerous other Illustrations).

Introduction.—Having finished a somewhat exhaustive list of the land and fresh-water molluscs of Essex,¹ one of the present writers felt that if he were to make any further contributions of importance to a knowledge of the fauna of that interesting county, he must turn his attention to some other group of animals. It seemed most fitting that some creatures should be chosen which are commonly met with during the search for molluscs. Centipedes, millepedes, and woodlice fulfilled these conditions, and all were collected, but as only seventeen species of woodlice had at the time been found in England, it was deemed advisable to study these in detail to begin with. The present contribution is the result of the undertaking, and we have thought that a general consideration of the British Woodlice, with careful drawings from nature of all the species now known from this country, ought to lead to a more general study of these interesting creatures and their habits.

Position in the scheme of classification.—The Woodlice belong to an immense group of invertebrate animals known as the Arthropoda, the bodies of which are segmented and provided with jointed appendages for purposes of walking, swimming, and feeding. Of this group, two large divisions are recognized. The first contains the forms which breathe by means of air tubes, such as the Insects; and the second has been constituted for Crustacea, which breathe by means of gills. The latter are, of course, adapted more especially for a life in water, but here and there we come across examples so modified that they can exist in air. The land-crabs are a case in point, and so are the Woodlice. These belong to an order which contains many fresh-water and marine species, known as the Isopoda.

Geological history.—The known history of the order is a long one, for remains occur in the Old Red Sandstone (Devonian) of Herefordshire, and in the Coal Measures. (79²). A form

¹ "The Non-Marine Molluscs of Essex," by Wilfred Mark Webb; *ESSEX NATURALIST*, Vol. x. (1897), pp. 27-48 and 65-81.

² The numbers in brackets refer to papers mentioned in the Bibliography at the end.

which has been named *Archæoniscus brodiei*, and is said to be referable to the recent family Aegidae is found in some numbers in the Purbeck Beds (Upper Jurassic), of this country (47). Fossil Isopods have also been recorded from the Oolite and from the Oligocene (Isle of Wight).

Turning to the Woodlice proper, we find that they first make their appearance in the Miocene (of Oenigen and Baden), and occur also in amber (79); while examples of the genera, such as *Oniscus* and *Porcellio*, have been discovered in late Tertiary deposits (47).

External structure and appendages.—Woodlice agree

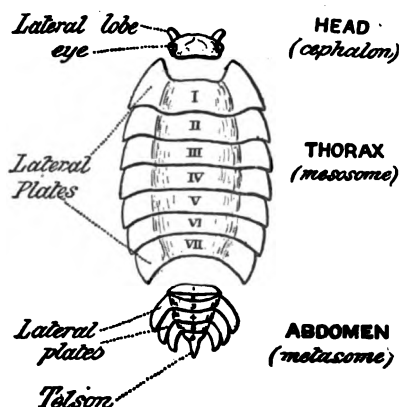


FIG. 1.—PARTS OF THE BODY.
(*Oniscus asellus*.)

in being of a somewhat oval form, and their bodies are arched, the curve varying in different genera and species. A *head* is to be distinguished; behind this comes the *thorax* of seven segments which are often considerably broader than the six succeeding ones which form the *abdomen* (see fig. 1.)

The head carries two *large antennae* (fig. 3) which are very evident, and a careful search with a lens will reveal a second and minute pair (the *smaller antennae*) situated between the base of the others, and really anterior to them. (figs. 2 and 4.)

The larger antennae are customarily bent at certain points, and we can distinguish a



FIG. 2.—THE FIRST ANTENNA.
(*Oniscus asellus*.)

terminal part, or *flagellum*, and a basal part, the *peduncle* (fig. 3). The number of joints in these structures, which varies in different genera and species, forms a useful classificatory character, and

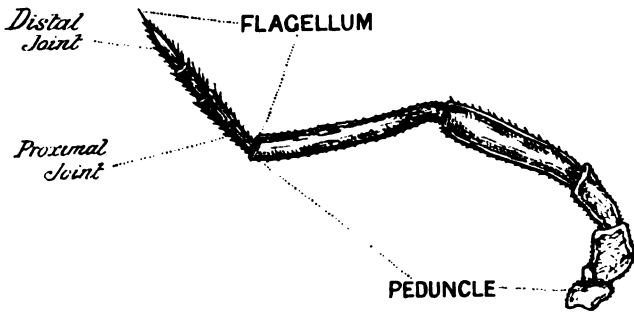


FIG. 3.—THE SECOND ANTENNA.
(*Oniscus asellus*.)

the relative length of the component parts is of considerable value in distinguishing species.

There are four pairs of mouth appendages—namely the jaws

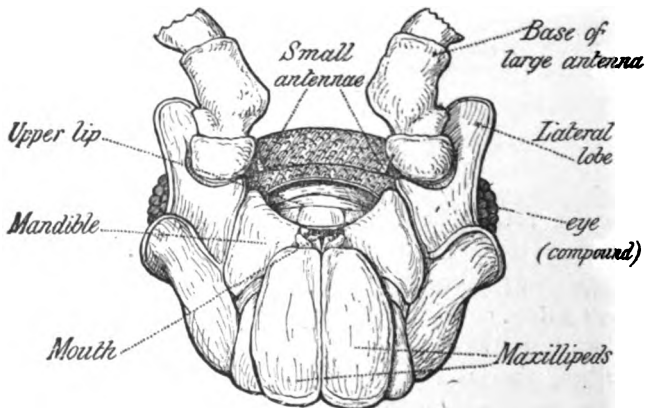


FIG. 4.—THE UNDERSIDE OF THE HEAD.
(*Oniscus asellus*.)

or mandibles (fig. 5), the *first maxillae* (fig. 6), the *second maxillae* (fig. 7), and the *maxillipeds* (fig. 8). When the head is examined from the underside the last of these organs will be seen first, covering in the others.

A small median plate attached to the front of the head has been called "*the upper lip*" (fig. 9), while inside the mouth appendages is a little bilobed structure "*the lower lip*" (fig. 10).

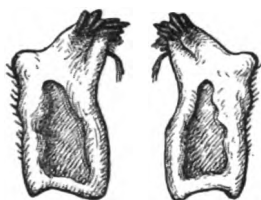


FIG. 5.—THE MANDIBLES.
(*Oniscus asellus*.)



FIG. 6.—THE FIRST MAXILLAE.
(*Oniscus asellus*.)

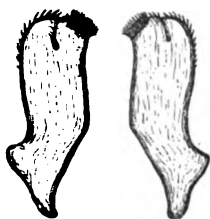


FIG. 7.—THE SECOND MAXILLAE.
(*Oniscus asellus*.)

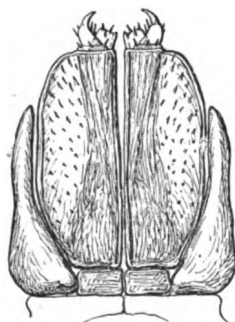


FIG. 8.—THE FUSED MAXILLIPEDS.
(*Oniscus asellus*.)

form a brood pouch, in which the eggs are carried (fig. 12) until they are hatched, and in which the young ones remain for some time afterwards.

When we examine the abdomen, we find that the appendages are plate-like, with the exception of the last pair (fig. 13), and



FIG. 9.—THE "UPPER LIP."
(*Oniscus asellus*.)



FIG. 10.—THE "LOWER LIP."
(*Oniscus asellus*.)

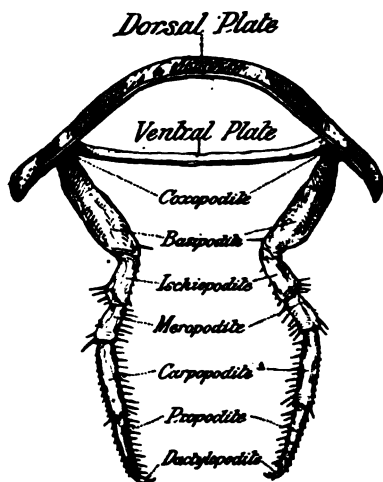


FIG. 11.—A TYPICAL THORACIC SEGMENT
(*Oniscus asellus*.)

they all agree in having two divisions, an arrangement which would prove awkward in limbs used for walking or feeling.

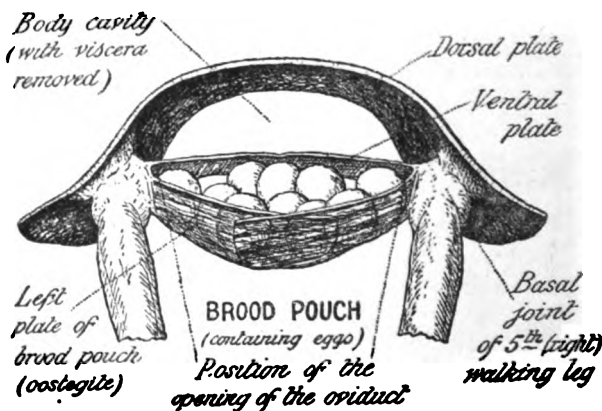


FIG. 12.—THE FIFTH THORACIC SEGMENT OF A FEMALE.
(*Oniscus asellus*.)

The inner plate (or endopodite) is in structure a gill, but the blood that passes through it, is enabled to take up oxygen

from moist air, while the outer division (or exopodite) acts as a protecting cover (fig. 14). In *Porcellin*, air-tubes (*tracheae*) may

be present (see below).

In the male the first two pairs of abdominal appendages are specially modified, the inner divisions (endopodites) being long and pointed (figs. 15 and 16). The last pair, or tail appendages, in the male are often considerably larger than in the

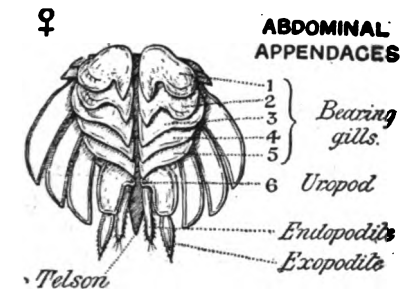


FIG. 13.—THE UNDERSIDE OF THE ABDOMEN OF A FEMALE. (*Oniscus asellus*.)

female, and the form of these structures is sometimes of value in classification.

Alimentary canal.—The main portion of the alimentary system is, practically speaking, a straight tube (fig. 17). Its first part (not shown in the figure) is a narrow gullet, which after passing through the nerve collar dilates to form a sort of stomach. Into this the secretion of four digestive glands is poured by two ducts. These glands have a somewhat striking appearance, being yellow tubes spirally

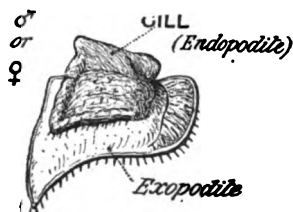


FIG. 14.—A TYPICAL ABDOMINAL APPENDAGE. (*Oniscus asellus*.)

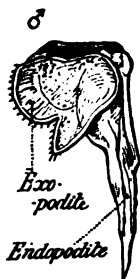


FIG. 15.—THE FIRST ABDOMINAL APPENDAGE OF THE MALE. (*Oniscus asellus*.)

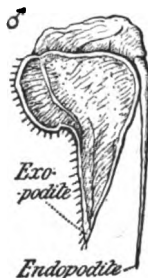


FIG. 16.—THE SECOND ABDOMINAL APPENDAGE OF THE MALE. (*Oniscus asellus*.)

coiled, and they end blindly. From the stomach the intestine runs to the hinder end of the body and passes under the heart.

Circulatory system—The blood being aerated in the abdominal appendages, we find that the heart is situated towards the hinder end of the body (fig. 18). Three main arteries supply the thorax and head, while the blood is brought from the gills to the heart.

Excretory system.—The excretory organs consist of a (a) pair of so-called "shell glands," which are considered to be the equivalents of the excretory tubes or nephridia of annelid

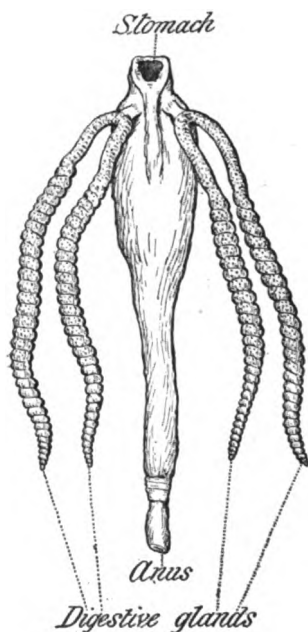


FIG. 17.—THE ALIMENTARY CANAL.
(*Oniscus asellus*.)

worms. In the woodlouse these excretory organs open on the second pair of maxillae. They are composed of a tube (*sacculus*) closed at one end and more or less bent upon itself (5, p. 261) which communicates with a *labyrinth* that is provided with an excretory orifice. Matters are eliminated by the *epithelial cells* [the histology has been described and figured in *Ligidium hypnorum* (66)], which are very large in *Ligia oceanica*.

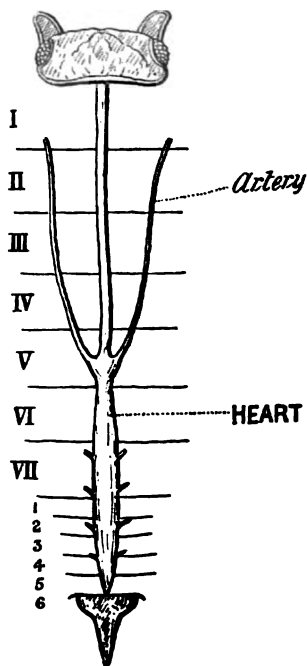


FIG. 18.—THE CIRCULATORY SYSTEM.
(*Oniscus asellus*.)

(b) Masses of cellules in the head, very greatly developed in *Ligia oceanica* (but numbering scarcely more than ten in *Oniscus asellus*), which have no external opening. They also function as excretory organs (5, p. 263), and have been called "cephalic nephrocytes."

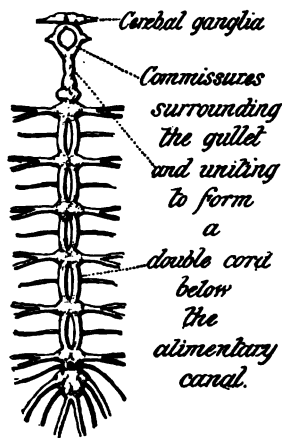


FIG. 19.—THE NERVOUS SYSTEM.
(*Oniscus asellus*.)

or less continuous in *Oniscus* (5, p. 265).

(d) The digestive glands have also been shown to be excretory (5, p. 270).

Nervous system.—

The nervous system consists of *paired ganglia* in the head, above the alimentary canal which send off nerves (*commissures*) that meet below, to form a *double nerve cord* with ganglia at intervals. (see fig. 19).

Reproductive organs.

—In the female there are a pair of *ovaries* in the positions shewn in fig. 20; and *ducts* run to the underside of the fifth thoracic segment.

(c) Other "branchial nephrocytes" are situated on the dorsal surface between the last thoracic and the first abdominal segments, as well as between those that follow, with the exception of the last two; they are in distinct patches, one on each of the middle line in *Ligia*, but more

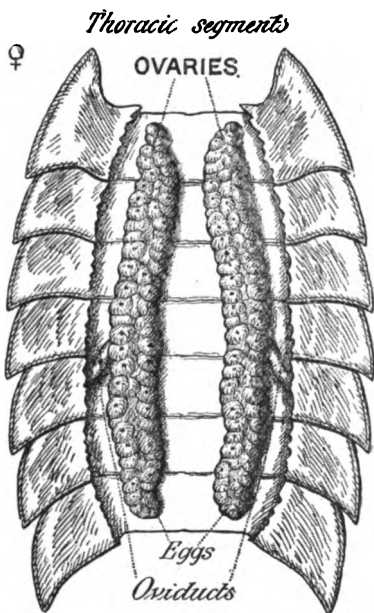


FIG. 20.—FEMALE REPRODUCTIVE ORGANS.
(*Oniscus asellus*.)

The openings are very difficult to identify, and Lereboullet (39, p. 113) was unable to find them. It is obvious that the openings must be underneath the plates that form the egg pouch, and as a change of skin is required to set these free, it would appear that at ordinary seasons the ducts from the ovaries are closed. The writers have been able to determine from external examination of specimens which had moulted and were about to lay eggs, that the oviducts at such time open to the inside of the base of each walking leg on the fifth segment. In similar specimens the oviducts were also followed to the opening from within. The *brood pouch* has already been described.

The male organs consist of six *testes* arranged in two pairs, each of which is provided with a *reservoir* (see fig. 21). The efferent ducts from the two reservoirs unite at the base of the thorax to form a common duct (or "penis").

Development.—The eggs, in the common species of woodlice, at least, are laid at the

beginning of summer, and are retained in the brood pouch, where they undergo their development. The process has been recently traced with great care by Professor Louis Roule (58) in *Porcellio scaber* and the description which follows is based upon his researches.

As, practically speaking, the larval stages are passed within the egg, and there is no free embryo differing in form from the

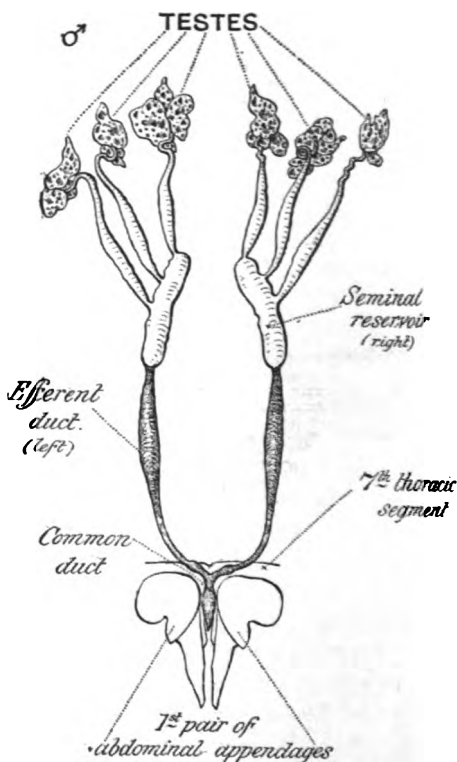


FIG. 21.—THE MALE REPRODUCTORY ORGANS.
(*Oniscus asellus*.)

parent, it is necessary for the young creatures to be well supplied with nutritive material. In fact, the bulk of the large egg is made up of *food-yolk*, on the outside of which the *formative protoplasm* is disposed in irregular patches. In the fertilized ovum, one of the latter, which lies in a particular position at the end, is found to be larger than the others (see fig. 22). It contains the nucleus of the egg-cell (see fig. 23) and is called the *cicatricula*. This is the only portion of the egg which divides and produces *nucleated cells*. It is these which gradually spread all over the surface of the food-yolk, forming a layer known as the *blastoderm*, which is at first but one cell thick (see figs. 24, 26, and 28).

Before, however, the food-yolk is quite closed in, a differentiation into two layers—the *pro-ectoderm* and *pro-endoderm*—takes place (see fig. 25) and rudiments of the first two pairs of

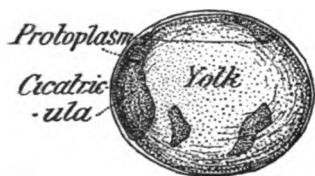


FIG. 22.—THE FERTILIZED EGG (*Porcellio scaber*), AFTER ROULE.

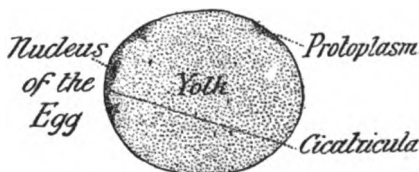


FIG. 23.—THE FERTILIZED EGG SEEN IN SECTION (*Porcellio scaber*), AFTER ROULE.

appendages appear (see fig. 26). Moreover, the cells of the ectoderm change their shape and begin to multiply at two points to form the beginnings of the cerebral ganglia and the nerve cord respectively.

As the blastoderm closes over the food-yolk, two more appendages arise and these are soon followed by others (see fig. 28). A depression appears at the point where the blastoderm closed and internally the pro-endoderm or inner layer is differentiated into two—the *endoderm proper* and the *mesoderm* (see fig. 29). The former begins to grow so that its edges unite to form the middle part of the intestine (see fig. 29) seen from the outside in fig. 30. The depression already mentioned grows deeper, forming a tube which is the hind portion of the *intestine*, while at the anterior end of the embryo the front part of the intestine is similarly formed (see fig. 30). By this time also all the nineteen

SURFACE VIEWS.

OPTICAL SECTIONS.

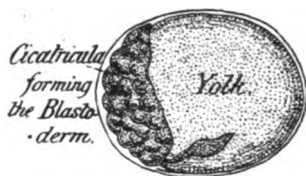


FIG. 24.

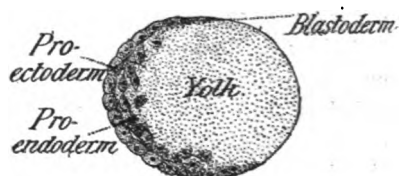


FIG. 25.

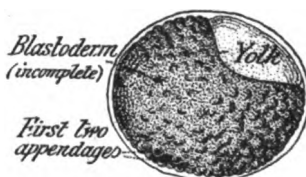


FIG. 26.



FIG. 27.

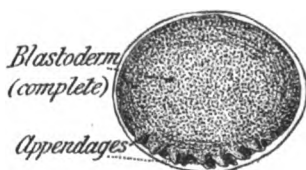


FIG. 28.

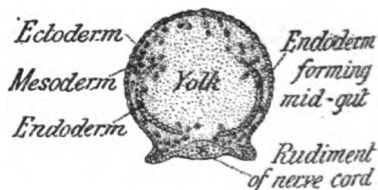


FIG. 29.

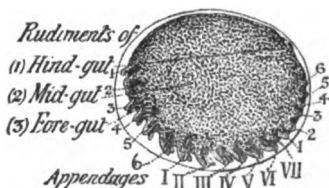


FIG. 30.

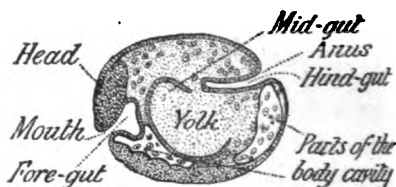


FIG. 31.

THE DEVELOPMENT OF A WOODLOUSE (*Porcellio scaber*), AFTER ROULE.

Figs. 24, 26, 28, 30, are Surface Views, and figs. 25, 27, 29, 31, which indicate slightly later stages respectively than the others, are of eggs seen in Optical Section.

appendages have made their appearance and the mesoderm, (which has grown considerably, to form the beginnings of the muscles) has sent prolongations into each of them. About this time, spaces (see fig. 31) are formed in the muscular mesoderm which are all that remain of the *true body cavity* characteristic of animals above the level of the jelly-fish, and in these spaces the blood ultimately circulates.

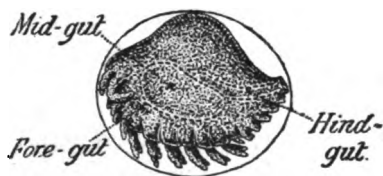


FIG. 32.—EMBRYO OF THE WOODLOUSE SHOWING THE THREE DIVISIONS OF THE INTESTINE SEPARATELY DEVELOPED (*Porcellio scaber*). AFTER ROULE.

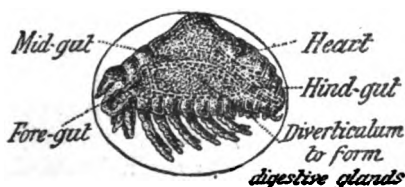


FIG. 33.—EMBRYO OF THE WOODLOUSE SHOWING TRACES OF THE SEGMENTS (*Porcellio scaber*). AFTER ROULE.



FIG. 34.—AN EMBRYO WOODLOUSE READY TO BE HATCHED (*Porcellio scaber*). AFTER ROULE.

The body next alters somewhat in shape and the three divisions of the intestine approach one another (see fig. 32) previous to their junction. As may be imagined during these processes the food-yolk has gradually been used up and the space which it occupied taken by the internal organs, which we have mentioned.

In the last stages of the development the appendages become larger still, the *heart* makes its appearance, segmentation of the body is completed, and except that the seventh pair of walking legs are as yet rudimentary the woodlouse is completed. It is only after hatching that the

pair of legs mentioned, attain to their normal length.

The process of segmentation of the egg and the formation of its layers lasts about a fortnight, while the completion of the development proceeds much more rapidly, for another three weeks bring it to an end.

After the first moult or change of skin the last pair of

walking legs makes its appearance, and Mr. James B. Casserley [whose work one of us (75) has described elsewhere] found when keeping a number of the common pill-woodlouse (*Armadillidium vulgare*) in captivity that his specimens did not subsequently change their skins more than once in the six months during which he had them under observation. He also noted that the crustaceans go on growing after they are sexually mature. As his specimens grew older, Mr. Casserley noticed that their colour became darker, and a curious point recorded by him is that two examples of the same age may change their skins at the same time, and while one may have afterwards nearly twice as many markings, on the other very few at all will be seen. The time required for the growth of a woodlouse from the size of a pin's head to that of an adult example—say three-quarters-of-an-inch long—must be fairly considerable, taking into account the fact that any appreciable increase in size can only occur at a moult and Mr. Casserley's observations as to the infrequency of the process in *Armadillidium vulgare*.

Habits and Economic Considerations.—The construction of the breathing organs of woodlice, and the necessity which exists for these to be kept moist, restricts the habitats of the animals considerably. Woodlice are found under stones and logs, beneath the bark of dead and rotten trees, among decaying vegetable matter as well as living grass and moss in damp or wet situations. When looking for some of the common species under the bark of fallen trees it is surprising to notice that the crustaceans may be entirely absent from many trunks, while when another is examined which seems to differ very slightly, if at all, in condition or situation, they are found in swarms. There is no doubt but that the habits of woodlice would well repay the attention of naturalists, who are now recognizing that besides anatomy as such, and the classification which a knowledge of structure permits, there is the equally important consideration of the creatures as they live their own life and affect that of others. It is not our object to give a detailed account of the ecology of British woodlice, but rather to provide a basis from which it may be approached. Nevertheless a few general remarks may not come amiss. Many points in the life-history of woodlice may no doubt be learned by keeping them in captivity and there is

just sufficient difficulty in doing this successfully to give an interest to the matter.

Apart from a supply of proper food, we take it that the chief object to be attained is the provision of the amount of moisture required by the particular species under examination, together with a sufficient supply of air.

A great many interesting observations can be thus carried out, such as those of Mr. Casserley, to which allusion has already been made. The process of moulting for instance is well worth watching, and although specimens with half their coat changed may be found in remote corners, yet the whole course of the moult can be seen much better in the case of captive woodlice. The following account is taken from Mr. Casserley's description (75) of what happens in the case of *Armadillidium vulgare*:—The approach of the moult is indicated by the appearance of a white border on each segment of the body, which becomes gradually more marked, while at the same time the animal is seen to be less active and often makes a small burrow in which to hide. Sometimes a sheltered corner against a stone is looked upon as affording sufficient protection, but, in either case each woodlouse keeps to the place originally chosen. About ten days after the white lines have become visible the animal appears to be divided into two. Its skin is becoming loose and little movement can take place at the joints of its body with the exception of that between the fourth and fifth thoracic segments where the skin will ultimately break. The woodlouse spends a day or two in this condition and then, by suddenly walking forward, frees itself from the covering of the hinder portion of its body. The three last pairs of walking legs are carefully pulled out from the old skin, which now appears perfectly white, and at the same time the lining of the hind portion of the alimentary canal (hind gut) is also shed. After putting the tender half of his body well into his corner or burrow the woodlouse proceeds to eat the part of his skin that he has cast. The creature has now a very odd appearance. His front half with the exception of the white edges is as it was before, the rest of him instead of a light slaty blue, and is very soft as well as proportionately a little larger.

In three days or so the tail end becomes hard and attains the normal colour. Then the old skin from the front half is pushed off and the creature becomes practically defenceless, so much

so in fact, that any of his species that happen to find him will attack him and eat all his front half, rejecting, however, his now hardened tail-end.

Provided that the moulting woodlouse has survived (and in captivity, to ensure this, he must be isolated), after three days his jaws will be sufficiently hardened to allow of his eating, and usually he first of all devours the second half of his cast skin. The operation of moulting does not occupy quite so long a time in the case of young examples. Specimens half-an-inch long do not moult more than once in six months and show but little increase in size after the process.

Woodlice do not appear to live on either animal or vegetable food alone, but adopt a mixed diet. It is, however, owing to their attacks upon cultivated plants that the creatures are looked upon as pests by the horticulturalist. The animals feed either in the night or in the very early morning, on seedlings, orchid tubers, mushrooms, or anything that comes to hand. Few of the accounts, however, of their ravages, mention that the crustaceans have been caught absolutely in the act of doing the damage ascribed to them. Some careful inquiries have nevertheless enabled us to discover several observers who have watched woodlice feeding. Mr. F. V. Theobald, of Wye College, and one of the students at Swanley Horticultural College are among the number. The former has also given us an account of the methods, out of many tried, which he has found most successful for getting rid of the crustaceans. Out of doors trapping with moss, sacking or horse-dung is best. In glass houses, fumigation with hydro-cyanic acid gas has cleared them out, and poison baits, especially potatoes cut and soaked in white arsenic, have done some good. Stable manure is especially favourable to these creatures, particularly when it is used "long": in this condition it should therefore be avoided.

It is interesting to note how the woodlice in winter simply remain where they happen to be so long as there is sufficient moisture, though they are ready to run about as rapidly for a time as in summer, should they happen to be disturbed.

No doubt many points of inter-relation between woodlice and other animals remain to be discovered. Mr. John W. Odell tells us that on Exmoor, in the open, he found no *Armadillidia*, though other forms occurred under nine out of every ten stones

that he turned over, and here the smaller species of ants also abounded. Close to stone walls *Armadillidia* were to be seen to the exclusion of all other genera, and this state of affairs was ascribed by Mr. Odell to the presence of swarms of the large wood-ants which he considers would make short work of any woodlice that could not protect themselves by rolling up.

We ought not to conclude this account without mentioning the fact that woodlice once played an important part in medicine.

Doctor Fernie (28) gives some interesting extracts with regard to the hoglouse and the woodlouse. The latter he seems to have identified quite correctly as *Oniscus asellus*. He calls the former, however, indiscriminately, "the common armadillo" (which is the old name for the pill-woodlice now known as *Armadillidium*), "the pill millipede" and "*Glomeris marginata*." The last two names are those of another creature, not a crustacean, which when it is rolled up can be very easily mistaken for an *Armadillidium*, though, when it uncurls, it will be seen to have many more than seven pairs of legs. The local appellations applied to the hog-louse by Doctor Fernie, and his remarks with regard to its commonness, tend to show that it is *Armadillidium vulgare*, to which he really refers, and the use of which in medicine was commonly general.

Hog-lice were prescribed for scrofulous diseases and obstructions of the liver and digestive organs, among other things, and the London College of Physicians directed that the creatures should be prepared by suspending them in a thin canvas bag placed within a covered vessel over the steam of hot spirit or wine, so that being killed by the spirit they might become friable. Hog-lice and Wood-lice were also administered alive, while the former were also put down the throats of cows "to promote the restoration" of their cud, hence their name of "cud-worm." There seems to be considerable evidence that even in modern times Wood-lice have had considerable remedial effect which depends upon an alkaliescent fluid contained in them.

Local Names.—Among the local names by which these creatures are known are those of "sow bug," "lucre pig" (Berkshire), "carpenter" and "chiselhog" (Berkshire). Doctor Fernie (28) gives a number of others:—"thrush-louse," "tiggyhog," "cheslip," "kitchenball," "chiselbob," "lugdor,"

‘palmer,’ and ‘cudworm.’ In the eastern counties the same writer notes that they are known as “old-sows” or “St. Anthony’s hogs” while the Welsh call them “little grey-hogs,” “the little old women of the wood” or “grammar-sows,” grammar signifying a shrivelled up old dame. *Oniscus asellus* was sometimes called “socchetre,” “church louse,” and “chinch.”

Methods of Collection and Preservation.—Woodlice should be collected straightway into tubes or bottles half filled with 30 per cent. methylated spirit.³ Woodlice dropped into this weak spirit become gradually narcotised and die, and they remain limp enough for purposes of examination or to allow, of their legs and antennæ being set out during the process of mounting. Specimens to be kept permanently should be placed in 70 per cent. alcohol. For storage purposes the specimens of each species from a given locality should be put together into a small flat bottomed tube such as are used for pillules by apothecaries or specially made for natural history purposes. A paper label on which the name, locality, date of capture and any other necessary particulars have been written with dark lead pencil, is not affected by the spirit. The tubes may be corked, though if not frequently examined all the spirit may evaporate, and cause the specimens to be spoilt. A safer method is to plug the tubes with cotton wool and keep all those containing a given species or specimens from a particular locality beneath the surface of spirit in a large wide-mouthed bottle, into which first of all some cotton wool has been put to prevent the tubes from coming into sudden contact with the glass at the bottom. For show purposes in museums, specimens taken direct from 30 per cent. spirit should be mounted on slips of opal glass by means of gum-tragacanth which has been powdered and shaken up in spirit before having water added to it. The slips can be exhibited in glass tubes, six inches high by one across, or in narrow stoppered museum jars. A variation of the method is to mount the animals on clear glass and to place behind them another strip of any colour that may be preferred.

3. It should be pointed out that the methylated spirit now sold in the shops contains mineral naphtha and goes milky on the addition of water. Permission can be obtained from Somerset House to buy what is still called “ordinary methylated spirit,” but at present five gallons has to be purchased at one time.

Classification.—The various genera of woodlice are connected together so closely, by intermediate forms, that their division into families is to a very great extent, arbitrary. Bate and Westwood described but a single family Oniscidæ (1), though they distinguished two sub-families :—Ligiinæ, which included the forms with many joints to the flagellum of the antenna, and Oniscinæ, which contained the rest.

Since then the pill-woodlice have been thought by some, to be sufficiently different from the other genera to warrant their separation, and three families namely, Ligiidæ, Oniscidæ, and Armadillidæ have been recognized, as for instance by Dr. Scharff (63).

A fourth family—Trichoniscidæ—has been added by Professor G. O. Sars, who in his *Crustacea of Norway* (59) alludes to the division of the tribe into the sections Ligia and Onisci and has adopted the following classification :—

Order--ISOPODA.

Tribe--ONISCOIDA.

Family I.—LIGIIDÆ.

Ligia.

Ligidium.

Family III.—ONISCIDÆ.

Oniscus.

Philescia.

Platyarthrus.

Porcellio.

Metoponorthus.

Cylisticus

Family II.—TRICHONISCIDÆ.

Trichoniscus.

Trichoniscoides.

Haplophthalmus.

Family IV.—ARMADILLIDÆ.

Armadillidium.

All the genera described by Professor Sars are represented in the British Islands.

Below is a scheme of classification and synopsis of the characters of British genera of woodlice which we have compiled in order to render easy the determination of the genus to which any particular specimen may belong.

SCHEME OF CLASSIFICATION AND SYNOPSIS OF GENERIC CHARACTERS.

Order—ISOPODA.

Tribe—ONISCOIDA.

Section I.—LIGIÆ.

The Two Divisions of the Tail Appendages alike in Shape.

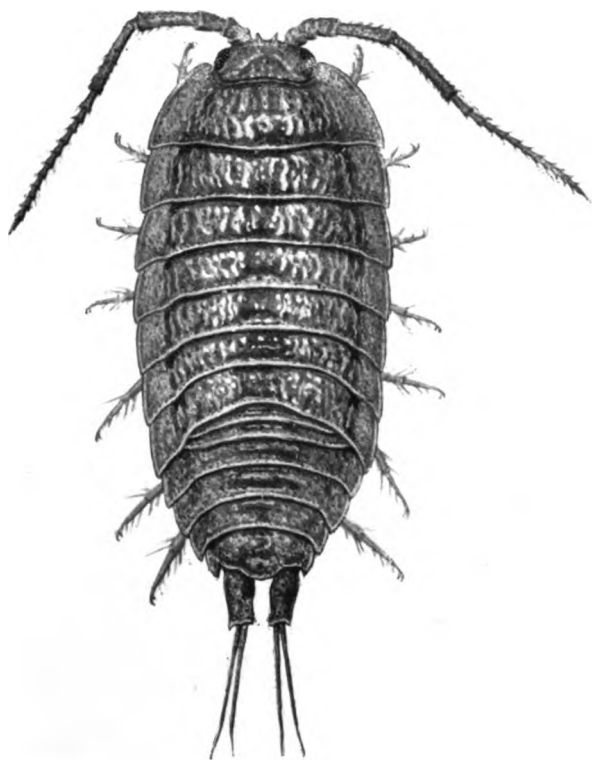
- (A.)—Flagellum with 10 or more joints; tail appendages wholly visible; head without lateral lobes - LIGIIDÆ.
 (1.)—Abdomen broad; body large; habitat the sea-shore - *Ligia*.
 (2.)—Abdomen narrow; habitat wet moss - *Ligidium*.
 (B.)—Flagellum with less than 10 joints; head with small lateral lobes, tail appendages partly covered TRICHONISCIDÆ.
 (3.)—Abdomen narrow; eyes compound; flagellum usually with more than 3 joints - *Trichoniscus*.
 (4.)—Abdomen narrow; eyes simple or wanting; flagellum with 4 joints - *Trichoniscoides*.
 (5.)—Abdomen broad (comparatively); eyes simple; back with longitudinal ridges; flagellum with 3 joints - *Haplophthalmus*.

Section II.—ONISCI.

The Outer Divisions of the Tail Appendages Broader than the Inner.

- (A.)—Tail appendages projecting when the animal is walking - ONISCIDÆ.
 (a.)—Unable to roll up into a complete ball.
 (6.)—Flagellum with 3 joints; abdomen broad; head, with lateral lobes - *Oniscus*.
 (7.)—Flagellum with 3 joints; abdomen narrow; head without lateral lobes - *Philoscia*.
 (8.)—Flagellum with 1 joint; eyes wanting; abdomen broad; habitat, ant's nests - *Platvarthrus*.
 (9.)—Flagellum with 2 joints; abdomen broad; frontal lobe projecting - *Porcellio*.
 (10.)—Flagellum with 2 joints; abdomen narrow - *Metoponorthus*.
 (b.)—Able to roll up into a complete ball.
 (11.)—Flagellum with 2 joints; antennae folded together over the thorax when the animal is rolled up into a ball - *Cylisticus*.
 (B.)—Tail appendages not projecting when the animal is walking - ARMADILLIDIIDÆ.
 (12.)—Flagellum with 2 joints; antennae hidden or carried at the sides of the head when the animal is rolled up into a ball - *Armadillidium*.

[To be continued.]

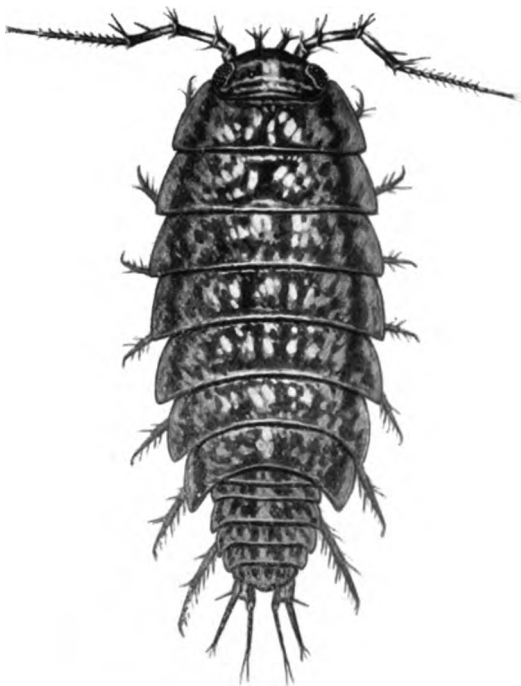


LIGIA OCEANICA Linné. THE QUAY-LOUSE.

Length, two to three centimetres.

Charles Sillem, del. ad nat.

F. W. Reader, sculpt

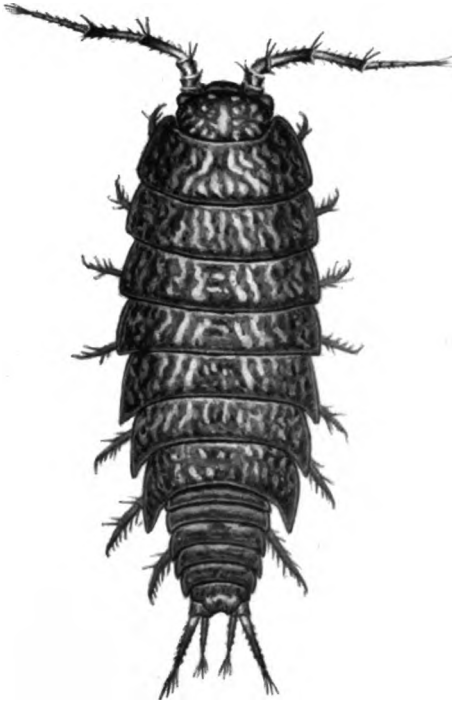


LIGIDIUM HYPNORUM Cuvier.

Length, nine millimetres.

Charles Sillem, del. ad nat.

F. W. Reader, sculpt.



TRICHONISCUS PUSILLUS Brandt.

Length, four millimetres.

Charles Sillem, del. ad nat.

F. W. Reader, sculpt.

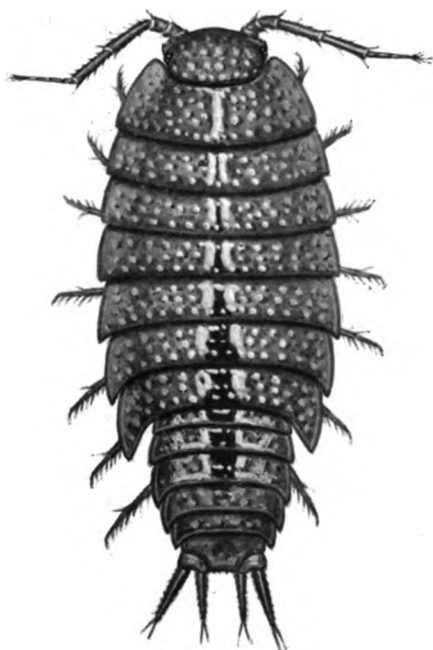


TRICHONISCUS VIVIDUS Koch.

Length, eight millimetres.

Charles Sillem, del. ad nat.

F. W. Reader, sculpt.

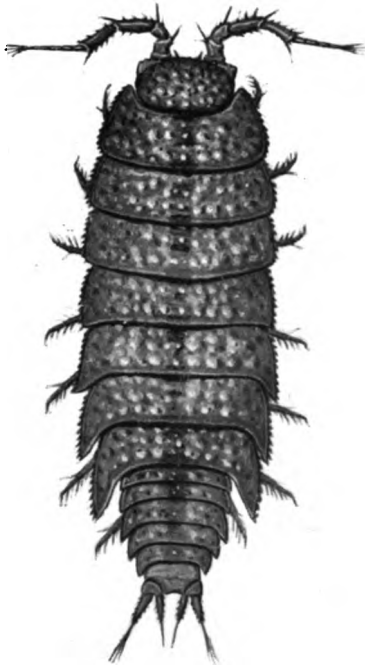


TRICHONISCUS ROSEUS Koch.

Length, five millimetres.

Charles Sillem, del. ad nat.

F. W. Reader, sculpt.

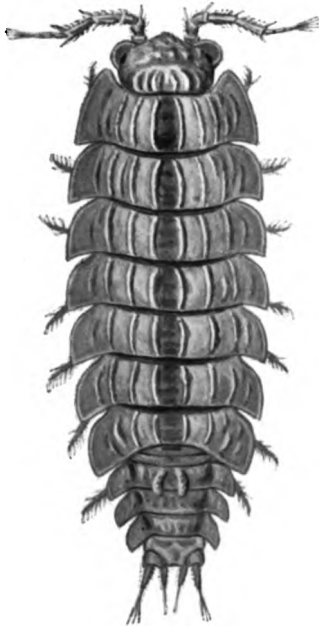


TRICHONISCOIDES ALBIDUS Budde-Lund.

Length, four millimetres.

Charles Sillem, del. ad nat.

F. W. Reader, sculpt.

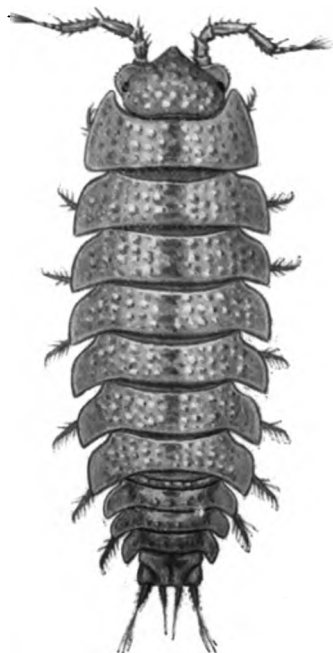


HAPLOPHTHALMUS MENGII Zaddach.

Length, three to four millimetres.

Charles Sillem, del. ad nat.

F. W. Reader, sculpt.

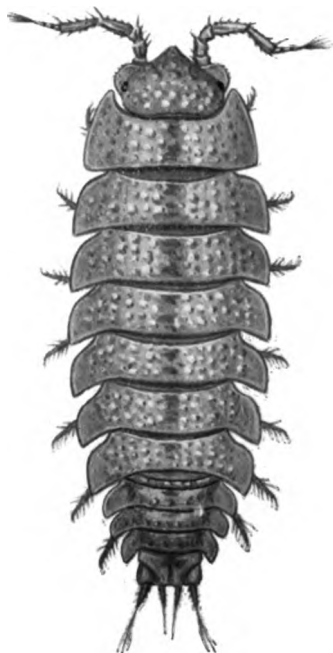


HAPLOPHTHALMUS DANICUS Budde-Lund.

Length, three to four millimetres.

Charles Sillem, del. ad nat.

F. W. Reader, sculpt.

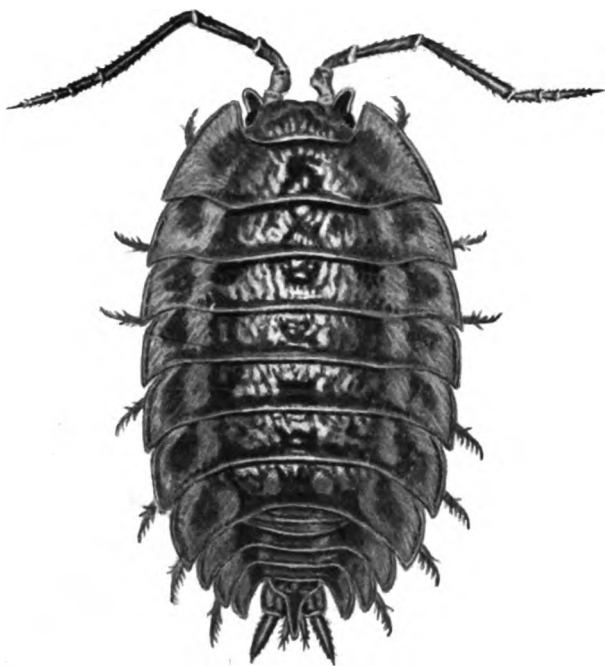


HAPLOPHTHALMUS DANICUS Budde-Lund.

Length, three to four millimetres.

Charles Sillem, del. ad nat.

F. W. Reader, sculpt.



ONISCUS ASELLUS Linné (The common slater).

Length, sixteen millimetres.

Charles Sillem, del. ad nat.

F. W. Reader, sculpt.

importation of foreign plait, but hard as it seems on widows and old folks, perhaps it is not an unmixed evil, for, as an old man remarked, "when the wives earned ten or twelve shillings a week, their men wouldn't work ; now they must."

My thanks are due to Mr. Sidney Browning for taking the photographs used in illustrating this paper.

[At the conclusion of the paper the President exhibited seven examples of fine plaiting, which he had obtained from Mr. William Simmons, of Castle Hedingham, whose name appeared in *Kelly's Directory* (1886) as that of a "Straw Plait Dealer." Owing to the sudden cessation of the trade a large stock is left in this dealer's hands.

Mr. Bryan Corcoran showed a small straw-mill which had, in recent times, been furnished with a hopper, and converted into a bird-seed crushing mill.

In the course of the discussion following the reading of the paper, Mr. Gould stated that the chief of several causes for the decay of the industry is that English wheat-straw is heavier than the Japanese, and ladies will have hats of light weight. The material is now so cheapened that we no longer find ladies turning and re-turning straw hats as in the days of a generation ago, when a hat was expected to last for years instead of a few months.

The present-day straw plaits of Hertfordshire and Bedfordshire are used almost wholly for men's hats.]

EXPLORATION OF THE RED-HILLS.

(PRELIMINARY ANNOUNCEMENT.)

A Committee has been formed by the Essex Archæological Society and the Essex Field Club for the systematic study of these interesting relics of antiquity, and the settlement, if possible, of the many questions relating to them. The Society of Antiquaries and the Club have each made grants of £10 towards the expenses of exploration, and other bodies and private persons are expected to subscribe.

The Committee consists of:—I. Chalkley Gould, F.S.A. (*Chairman*), F. Chancellor, F.R.I.B.A., Miller Christy, F.L.S., William Cole, F.L.S., Rev. T. H. Curling, B.A., W. H. Dalton, F.G.S., T. V. Holmes, F.G.S., Dr. H. Laver, F.S.A., Dr. Philip Laver, Professor R. Meldola, F.R.S., Charles H. Read, F.S.A., Colonel O. E. Ruck, R.E., F. W. Rudler, I.S.O., F.G.S., and H. Wilmer, C.E., *Hon. Sec. and Treasurer*, St. Alban's Crescent, Woodford Green, Essex.

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Essex Folk-Songs and Dialect.

As before stated, I am very desirous that an attempt at least should be made to preserve records of our Folk-Songs and peculiarities of dialect and intonation, before they are utterly exterminated by Cockney School-Boards and newspapers, while music-hall and concert ditties and the pronunciation of "Stratforde-atte-Bowe" reign in their stead. In this hope I have purchased the requisite Phonographic apparatus, and have made some progress in the art of recording.

But at the outset we are confronted by the difficulty of locating the few lingering native minstrels and *raconteurs*. As in the "Deserted Village":—

"No more the farmer's news, the barber's tale,

"No more the woodman's ballad shall prevail "

along our forsaken country-side; the true Essex *patois* will ere long be as impossible of recovery as the rhythm of Chaucer.

I should be be very grateful to any Essex patriot who will discover and enlist a warbler of the ancient folk or cradle-songs, or quaint harvest-home ballads—a clear voiced and sturdy old-time vocalist who will not fear to face the recording-horn of the phonograph.

This fascinating work of registering for all time native speech and song is being pursued vigorously in America and Austria, and in our own country in the Isle of Man. Essex has heretofore often come to the front in literary and scientific matters; let us then lead the way in rescuing the sound of the fast fading folk-song from oblivion.

I shall be glad to correspond with anyone about this.

WILLIAM COLE,

BUCKHURST HILL,
July, 1906.

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The

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JOURNAL

OF THE

ESSEX FIELD CLUB,

EDITED BY

WILLIAM COLE, F.L.S., F.E.S.,

Honorary Secretary and Curator.

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The Recording and Preservation of examples of the Folk-Songs and Dialect of Essex and East Anglia.

The statement on the wrapper of the July part of the *Essex NATURALIST* has aroused considerable attention, and I have received promises of help. Some experienced musicians and experimenters have also given valuable advice. Local societies have been induced to take up the subject, and I am hopeful that an important East Anglian organisation will actively co-operate in our own district.

A few experiments carried on during last autumn fully demonstrated the practicability of recording accurately local songs and dialect "pieces" by the phonograph, and we anticipate making substantial progress during the ensuing summer and autumn. Perhaps some of our fellow-members will aid in the way indicated in the first notice.

I hope to be in a position to announce details of the proposed Committee and its work in the near future.

WILLIAM COLE.

THE ESSEX MUSEUM OF NAT. HIST.,
ROMFORD ROAD,
STRATFORD, ESSEX.

February, 1907.

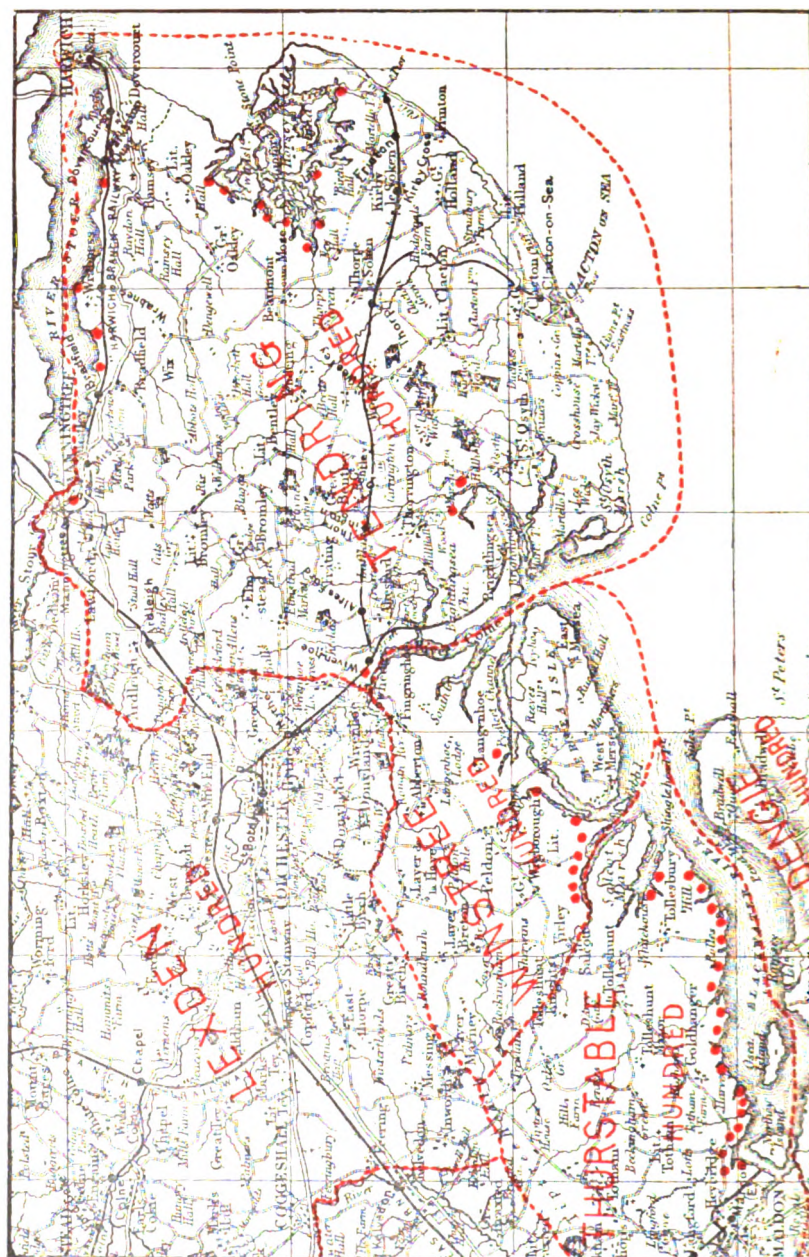


FIG. 1. MAP OF THE NORTHERN HALF OF THE ESSEX COAST, SHOWING APPROXIMATELY THE SITES OF THE FORTY-FIVE ESSEX VILLAGES MENTIONED IN DOMESDAY BOOK (1086).

A HISTORY OF SALT-MAKING IN ESSEX.

By MILLER CHRISTY, F.L.S., *President E.F.C.*

(*With Plates xxx, xxxi, and xxxii.*)

[*Read 7th April 1906.*]

THE English salt-manufacturing industry has been concentrated so long and so completely in the rock-salt districts of Cheshire and Worcestershire that it is practically extinct everywhere else in Britain. It will be news, therefore, to most people—even to Essex people—that salt is still made in Essex. And not only is this the case, but the industry is one of the very oldest now existing in the county. There is clear documentary evidence that it has been carried on here continuously since the time of King Edward the Confessor (1041-1066), nearly a thousand years ago, and there can be little or no doubt that it is really very much older. It seems probable that the industry originated in Essex before the time of the Romans. In any case, it had become of considerable importance in Saxon days. By Norman times, it had grown to a large industry—at least as important, probably, as in any other English county, except, perhaps, Sussex; and it continued to be of great importance with us right through the Middle Ages and modern times, down to about a century ago, when it declined greatly. At the present time, it is carried on at only one small, though prosperous, establishment. It is of the history of this very ancient, interesting, and necessary industry that I propose to treat in what follows.

Salt-making, like many of our more ancient industries, has left a record of its former prevalence in the county in our modern place and field names. In the first place, the industry has given name to one of our Essex parishes—namely Salcot, at the head of Salcot Creek—in which, undoubtedly, there once existed (as in not a few adjacent parishes) at least one “salt-cote”¹ at which salt was made. Then, again, in the parishes which abut upon the many creeks, estuaries, and inlets on our coast, there are not a few fields called by names which show that salt-works formerly existed in them.² Such are “East Salts” in Great

¹ The *New English Dictionary* defines a “salt-cote” as “a place where salt was wont to be made on the sea-shore.” Originally, no doubt, it was the small shed or “cote” in which the manufacture was carried on. “Cote” appears frequently in English, meaning a small building used as a residence (“cot” or “cottage”), or as a shelter for small animals (“dove-cote” or “sheep-cote”), or for making or housing anything (“peat-cote” or “salt-cote”).

² See Mr. W. C. Waller’s “List of Essex Field Names” in *Trans. Essex Archaeol. Soc.*, n.s., vol. v., p. 174; vi., pp. 79 and 273; vii., pp. 87 and 319; viii., p. 200, and ix., p. 267. The extensive “saltings” round our coast have, of course, no connection with salt-making.

Wakering, "Home Salt-coats" in Stow Maries, "Salcote-stone Field" in Tollesbury, "Salcots" in Brightlingsea, "Salt-acre Marsh" in East Mersea, "Salt-coat Marsh" in Burnham, "Salt-bridge Field" in Eastwood, "Salt-bridge Field" in Rochford, "Salt-pan Marsh" in Paglesham, "Salt-reach Field" in Eastwood, and "Salts" in Barking. Less easy of explanation are "Salt Acre" in Roydon, "Salt Field" in High Easter, and "Salt Pasture" in Bocking. These are all inland, and were named, perhaps, after some saline excrescence noticed in them. "Salt-box Field" in Waltham Holy Cross was probably so-called from its shape. "Salter's Field" and "Salter's Ten-acres" in Great Oakley commemorate, beyond doubt, the making of salt at that place. "Salter's Piece," in Sible Hedingham, lying far inland, takes its name probably from some former owner named Salter, who, however, must have derived that name from the fact that one of his ancestors followed the occupation of a "salter" or salt-maker. It is worth noting, too, that the inn-sign of the "Three Cups" (generally spoken of as the "Cups"), representing the armorial bearings of the Salters' Company³, still occurs five times in Essex—at Harwich, Great Oakley, Colchester, Maldon, and Springfield. Two of the houses bearing the sign are still large and well-known hotels, and all, except the last-named, are situated either actually on or close to that portion of our coast on which salt was made largely. Moreover, in 1777, according to Chapman and André's map, there was a sixth house bearing this sign at Manningtree—another Essex town at which salt was made at the time. Clearly, therefore, the sign is with us a relic of the industry.

The kind of salt made in Essex in early times was that known formerly as "bay salt"—that is, salt made by evaporating sea-water in shallow pans by means of sun-heat.⁴ The process, though successful in hot countries further south, must have been very tedious in our climate. Yet there can be no doubt that, during summer, salt could be made, and was made, by this means in Essex. The sea-water was let into large shallow ponds, where it remained until more or less reduced and

³ Per chevron, azure and gules; three-covered sprinkling-salts argent, sprinkling salt proper.

⁴ It was so called because it came originally from "La Baye" (of Biscay), round the shores of which there were many salt-evaporating pans.

concentrated by evaporation. The resulting brine was then further reduced and the salt crystallised by artificial heat.

The salt made here in later times (including the present) has been that known as "white salt"—that is, salt made by boiling sea-water by means of artificial heat. This latter process is now carried on nowhere in England (so far as I am aware), except at our one remaining salt factory, having been superseded everywhere else by the making of salt from rock-salt.

It seems probable that our Essex coast offers greater facilities for making salt from sea-water than any other part of the coast of England. In the first place, we have many extensive, shallow, narrow-mouthed estuaries, creeks, and inlets of the sea—together, probably, far larger, both in number and in area, than those of any other county. It is easy to understand that salt in large quantities must be deposited by evaporation on the extensive mud-flats and saltings which exist in and around these inlets, and that this salt must be taken up in solution and re-deposited, again and again, by each tide—twice, in fact, in every twenty-four hours—till the water becomes exceptionally salt. Further, these inlets lie on the east coast, where the rainfall is far less than on the west, and the water in them is likely, in consequence, to be less diluted by rain and river-water than the water in similar inlets lying on other coasts where the rainfall is greater. This comparatively-light rainfall and the extent, shallowness, and narrowness of our estuaries and inlets seem likely to cause the water in them to be of higher salinity than the water of other English inlets of the kind. It would be interesting if some of our chemical members would conduct experiments with a view to showing whether this is so or not, and, if so, to what extent.

However this may be, nearly all our Essex salt-works were situated, not on the open sea-coast, but on the shores of estuaries and inlets, and generally near their heads. Further, in Norman times (as will be seen from what follows), salt-pans were thickest around those inlets of the sea (as Hamford Water, The Ray, Salcot Creek, and Tollesbury Creek) which were *inlets merely*: not river estuaries. In these, probably, the water is of even higher salinity than that in the estuaries, as it is not diluted by river water. This is, no doubt, especially the case with Hamford Water, which is of very considerable extent, while its mouth is

very narrow and no river of any kind flows into it. At all events, there were many salt-pans round its shores in early days.

That the Romans made salt on our Essex coast is extremely probable, but I know of no actual evidence.⁵ That the Saxons did so is certain; for not a few of the salt-pans mentioned in Domesday Book are stated to have been in existence in the days of King Edward the Confessor.

By the time of the Normans, salt-making was a considerable industry upon our coast, and some forty-six salt-pans (*salinae*) are mentioned in the returns of the Great Domesday Survey made in 1086.⁶ All of these (with one exception) were situate on the northern half of our coast-line, in the Hundreds of Tendring, Winstree, and Thurstable, as shown on the accompanying map (Plate xxx).

In Tendring Hundred, there were seventeen salt-pans, three of which (and one other which was disused) had existed in the time of the Confessor. Lawford, Wrabness, Ramsey, Great Bentley, Thorrington, and Elmstead had one each; Bradfield, Great Oakley, Beaumont, and the three Sokens jointly had two each; while Moze had three. Several of these parishes and others which follow lay mainly inland and scarcely touched the salt water, as will be seen on reference to a map. Of these seventeen pans, it will be found that five were situated on the south bank of the Stour Estuary; nine round the shores of Hamford Water; and the remaining three on the north side of the Colne Estuary.

In Winstree Hundred, further south, there were eight salt-pans, none of which are stated specifically to have existed in the time of the Confessor. Of these eight pans, Peldon and Langenhoe (both on the channel separating Mersea Island from the mainland) had one each and Great Wigborough (near the head of Salcot Creek) had no less than six. In this Hundred, too, is the manor or parish of Salcot, which must have derived its name from salt-cotes which existed there in Saxon times, for none remained at the time of the Great Survey.

⁵ The late Canon J. C. Atkinson considered (see *Archaeol. Journ.*, xxxvii., pp. 196-199; also *Essex Review*, lli., pp. 276-277) that our "Salting-mounds" or "Red-hills" (which are probably older than Roman times) were the sites of old salt-works. Others have held the same view, but the evidence available so far does not suffice to enable us to decide of what ancient industry these mysterious mounds are a relic.

⁶ These were first studied by Dr. J. Horace Round (*Victoria Hist. of Essex*, i., pp. 380-382), to whose remarks on the subject I am much indebted.

In Thurstable Hundred, lying still further south, on the north bank of the Blackwater Estuary, there were no fewer than twenty salt-pans and one-half, of which three-and-one-half (and seven others which had disappeared) had existed in the time of the Confessor. Tolleshunt D'Arcy, Tolleshunt Major, Layer Marney, and Heybridge had one each; Goldhanger had one-and-a-half;⁷ Great Totham had two; Little Totham had three; while Tollesbury had six (five of these being in the manor of Tolleshunt Guisnes, where there had been no fewer than *twelve* pans in the time of the Confessor). Further, somewhere in this Hundred, the King had four pans, which were in charge of the Sheriff of the County. Most of these pans (probably about twelve of them) were on Tollesbury Creek (an inlet merely), and the remainder on the north side of the Blackwater Estuary.

The only other Essex salt-pan mentioned in Domesday Book was at the opposite extremity of the county, namely at Wanstead, in Becontree Hundred. The locality is not one in which a salt-pan might have been expected; yet the pan in question had existed since the time of King Edward the Confessor.^{7A} Wanstead lies mainly upon the River Roding, but it is scarcely credible that salt-water can ever have come up that river thus far. In all probability, therefore, the salt-pan was in the semi-detached portion of the parish (some 38½ acres in extent) which abutted on the River Lea, and was connected with the rest of the parish by a long narrow strip, known as Wanstead "Slip" or "Water slip."⁸ The right to this "Water-slip" was formerly guarded very jealously by the parish authorities, but later it became a source of trouble, and it has now been merged in adjacent parishes. In early days, the salt water may have come up the Lea to this point. The only other possible solution is that the so-called salt-pan was a salt refinery of some kind, but there is no evidence in support of this.^{8A}

From the foregoing, it would appear that, in Norman times, salt-making in Essex was confined practically to the three Hundreds mentioned above (namely, Tendring, Winstree, and

⁷ The other moiety belonged, no doubt, to some other parish. The rights of the two parishes were satisfied, probably, by dividing either the produce or the profits.

^{7A} See *Victoria Hist. of Essex*, i, p. 438.

⁸ For this suggestion, I am indebted to the kindness of our Vice-President, Mr. Walter Crouch, of Wanstead.

^{8A} As Professor Meldola has pointed out to me, a century ago there was a Salt's Green in or a little to the south of Leytonstone, but there is nothing to show that it had any connection with salt-making. It does not appear on modern maps.

Thurstable), which form the northern half of our coast-line. That this really was the case may be doubted. One cannot help thinking that many salt-pans must have existed in the four other Hundreds which form the southern half of our coast-line (namely, Dengie, Rochford, Barstable, and Chafford), but that, for some reason, they were not entered on the returns furnished by those who made the Great Domesday Survey.

At all events, it is certain that salt has been made, at some time or another, on this southern portion of our coast-line, as is proved by the field-names referred to above and other information given hereafter. In Dengie Hundred, on the north bank of the Crouch, there is still (as Dr. Laver has pointed out to me) a farm bearing the name of "Salt-coats," situated at the head of Clement's-Green Creek.⁹ Further, Benton says¹⁰ that "indications of old saltcotes or salt-pits" are to be found all along the south bank of the Crouch (in Rochford Hundred), from Hockley to Paglesham. In regard to Paglesham, Dr. Laver writes me as follows :—

"About 1820, when my father was tenant of East Hall, a marsh of thirteen acres, lying next the sea-wall and known as Salt-pan Marsh, was in grass. Its surface was very uneven, by reason of the large number of shallow ponds it contained—the pans in which sea-water had been evaporated formerly for salt-making. As my father wished to grow corn on it, he decided to level it, which he did during one winter by means of spade labour, thereby adding to the farm a most productive field. For many years after this, it was not uncommon for men working in the field to pick up small silver and copper coins—some, I believe, of the time of Charles II. : others, I fancy, earlier."

"I do not know when these salt-works ceased working; but there is evidence that they were in work so far back as the time of Queen Elizabeth. The materials of the store-houses were known to have been brought away after it fell into disuse and to have been used at East Hall in the erection of a barn, which was still standing in 1867. These timbers were of oak and were clearly of the age stated. Many of them retained grooves which had been intended to accommodate sliding window-shutters."

That salt-making continued to be a flourishing industry on the Essex coast throughout the Middle Ages is clear from the many references to it which occur in wills of the Fifteenth and Sixteenth Centuries.

Thus, in 1497, John Beriffe the Elder, merchant, of Brightlingsea, left, for the purchase of two bells for the parish

⁹ It is marked on Chapman and André's Map of Essex (1777)

¹⁰ *Hist. Rochford Hund.*, p. 286.

church, "one hundred marks which William Bounde and Robert Barlow owe me for one lot of salt."¹¹

In 1501, Henry Boode, of Burnham, left his house to his wife, except "the berne [barn] in which my salte lyeth" and a new shop with an inner chamber in which more salt lay, and he directed that she was not to meddle with these until the salt was out of them.¹²

In 1547, John Creke, of Hockley, describing himself as a "weller" (by which, clearly, he meant a salt-boiler), left to his son Thomas his "salcotte and iiij ledde belonging to the said salt house, with all other implements that a weller ought to have, but no salte."¹³ By "ledde," Creke meant, no doubt, leaden evaporating pans. His salt cote must have been in that small part of Hockley which extends northwards and abuts upon the estuary of the River Crouch.

On Whit-Sunday in 1532, when the churchwardens of Heybridge made a "play" and a feast in their church, they paid two pence "for a pecke of whyte salte"—made, no doubt, in the vicinity.¹⁴

On 1 June 1567, one Edward Goodding wrote from Ipswich to Sir William Cecil:¹⁵ "I trust to set the [salt-]house in Essex fullie on worke the nynthe of June at the furthest; and, upon one wick press made, I will await upon your honour."

The Rev. William Harrison, of Radwinter, writing in 1587, says¹⁶ that "as wel the baie as white [salt] are wrought and made in England, and more white also upon the west coast, toward Scotland, in Essex, and elsewhere, but of the salt water."

Salt-making continued to flourish on our coast until the beginning of the Nineteenth Century, when it began to decline.

In or about 1710, when some bill relating to the salt trade was before Parliament, a return was made of the places at which salt was then made in England¹⁷; and from this it appears that, in Essex, salt was made or refined at Manningtree, Colchester,

¹¹ Will dated 20 Jan. 1496-7, and proved 18 July 1497 (P.C.C., 10 Horne).

¹² Will dated 20 Feb. and proved 20 April 1502 (P.P.C., 12 Moone).

¹³ Will dated 28 Mar. 1547 (Archd. Essex, 10 Bastwick, 100-101).

¹⁴ See Nichols' *Illustrations of the Manners and Expenses of Ancient Times* (1797), p. 181.

¹⁵ S.P.D., Eliz., xliii., no. 1.

¹⁶ See Holinshed's *Chronicles*, i., p. 241. In the earlier edition (1577) the words "in Essex and elsewhere" did not appear.

¹⁷ See copy in Brit. Mus. (816. m. 13, ff. 108 and 109).

and Maldon; at all of which places, the refiners used "water-borne" coal for boiling their brine-pans.

At Colchester, the industry continued until at least 1793, when John Buckingham was a "dealer in salt" there, and John Luff kept a "Salt Office."¹⁸

At Manningtree, the industry survived even later; for, in 1823, one James Monteith, residing there, was described¹⁹ as a "salt-refiner and coal merchant."

In 1836, there were in England thirteen salt-works (or, rather, salt-refineries) making salt from rock-salt, using "sea water as a solvent." Of these, two are stated to have been in Essex—at Manningtree and Maldon.²⁰ Probably, however, it did not survive long at Manningtree.

At Maldon alone has the industry continued to the present day. That the town was formerly recognized generally as a centre of the salt-making trade is shown by the fact that, in 1785, a writer spoke²¹ of the demand for "the famous Maldon salt," while in 1823 another described²² Maldon as "famous for its salt." Yet it seems clear that much of the salt which passed as Maldon salt was made, in reality, in the adjacent parishes of Goldhanger and Heybridge, on the opposite side of the river.

In 1786, Morant wrote²³ that, at Goldhanger, there was a "a considerable salt-work, in which is used Rock-Salt brought from Cheshire, mixed with sea-water." This establishment was, apparently, still working at Goldhanger in 1819, when Cromwell wrote :—²⁴

"The salt-works here are considerable. Rock-salt from Cheshire was formerly used; but, in consequence of the erection of very extensive works by Messrs. Bridges, Johnson, and Co., the manufactory of salt from the sea-water by steam has been practised with considerable success."

In all probability, Cromwell here confuses the "very extensive works" of the firm named (which appear to have been, in reality, in the adjoining parish of Heybridge: see *post*) with the earlier salt-works at Goldhanger.

In 1889, our Past-Presidents, Dr. Laver and Mr. E. A. Fitch,

¹⁸ See *Ibid.*, *Directory*, 1793, ii., pp. 522 and 523. The "Salt Works" at the Hythe are shown on Thomas Sparrow's *Survey of Colchester* (1767) and on Chapman and Andre's Map of Essex (1777).

¹⁹ *Figot's Directory*, 1822, p. 293.

²⁰ See *Rep. of Select Com. on Salt (British India)* (1856), p. 218.

²¹ See John Phillips, *Treatise on Inland Navigation* (1785), p. 18.

²² *Figot's Directory*, 1836, p. 280.

²³ *Hist. of Essex*, i., p. 359. See also the *Hist. of Essex*, by "a Gentleman," v (1772), p. 385.

²⁴ *Excursions through Essex*, i, p. 41.



FIG. 2.—THE MALDON SALT-WORKS.
(From a photograph by MILLER CHRISTY.)



FIG. 3.—THE SETTLING-POND AT THE MALDON SALT-WORKS.
(From a photograph by MILLER CHRISTY.)

excavated the site of some old salt-works on Bound's Farm, Goldhanger (very likely those mentioned by Morant), and found extensive flues of brick, pipes and pans of lead, and some small coal which had been used, no doubt, for boiling the water. Dr. Laver has been good enough to give me the following information :—

“ On arriving [he says], we found the men working in a field next to a grass marsh just inside the sea-wall. This grass marsh had in it various depressions, some of which might have been old salt-pans, but one had been, apparently, the bed of a small creek, of which there were much more distinct traces outside the sea-wall.

“ In the ditch and bank of the field in which work was going on, and in the adjoining portion of a field to the east, we found the surface of the ground slightly raised, due to a thick superimposed stratum of burnt earth. In this red and black soil, trenches had laid bare the remains of the foundations of buildings; and, as the trenches extended, the general ground-plan became more or less clear. I regret now that I did not go to the expense of having a plan drawn to scale, as this could have been done quite easily.

“ At one place, there was a well about three feet square and three or four feet deep. It was lined with planking, which had been very well jointed, and had in it the remains of a wooden pump.

“ Not far off was a small square building which had evidently contained the furnace; and, close by it, in another small square building, there remained a hundredweight or two of very good coal, which looked exactly like the bright coal, known as “ Wall's End,” used years ago in the district.

“ Near these, again, were some shallow brick tanks, clearly evaporating pans, about six feet long, three feet broad, and one foot deep. Their sides were formed of double layers of brick, containing flues leading from the furnace. Originally, no doubt, they were lined with lead, some pieces of which we found; but, the flue being contained within the brickwork, the heat did not come into direct contact with the lead. From one of the tanks, a brick drain led to the well above mentioned.

“ All these remains were covered by about three feet of the burnt red and black soil mentioned above. We came to the conclusion that this salt-cote had been destroyed by fire, and that the *debris* had been spread evenly over the whole site, covering the boiling house and everything else.

“ We could find no clear evidence as to the exact date of construction of these works, but the size of the bricks used showed that the works had been built not later than Jacobean times.”

The firm of Bridges, Johnson, and Co., of Heybridge, seems to have disappeared before 1823, when one John Bridges (who had been probably a member of it) owned “ very extensive works ” in Heybridge.²⁵ These works were situated on the sea-wall facing Collier's Reach, close to Heybridge “ Basin,” and on a marsh which is still called “ Salt Court.” Here are yet to

²⁵ *Pigot's Directory*, 1823, p. 298.

be seen the ruins of extensive walls, built of shingle, bricks, and cement. Close at hand is a large salt-pan, about fifty yards square and still full of water, while traces of other pans may also be seen. Near the high road skirting the marsh is the store-house in which the manufactured salt was kept. It is now used as a malting. Local tradition says that the business carried on at these works never yielded a profit, and that they ceased working altogether on the abolition of the salt tax in 1825, a few years only after the buildings had been erected.²⁶ Indeed, the name of Bridges does not appear in *Pigot's Directory* for 1826.

At this time, however, one Robert Worraker, described²⁷ as a "salt-maker," was living at Heybridge, having, perhaps, bought Bridges' business. Later, either he or one of his descendants appears to have removed the works to near Full-bridge, at Maldon, on the opposite bank of the river. Here he carried on a small and dwindling business till 1882,²⁸ when, as the only alternative to closing the works altogether, he sold the whole concern to Mr. T. Elsey Bland, of Maldon. That gentleman has since carried on the business in the old works (Fig. 2 Pl. xxxi), with increasing success, trading as the Maldon Crystal Salt Company. The method of manufacture is as follows:—

At the top of the highest spring tides (unless there has been recent heavy rain), the salt water of the river is let into a small reservoir (Fig. 3, Pl. xxxi), some thirty-five feet square and fifteen feet deep, on the river bank. After sufficient time has been allowed for any sediment to settle, as much of the water as is required is pumped up into a large wooden tank, holding some 1,000 gallons, in which it is clarified by a simple process, the exact nature of which is not disclosed. This tank is in the works (shown in Fig. 2). After this, the water is run off into two large boiling-pans, each about ten feet square and a foot deep, in which it is again "fined" by a simple process. The fires which heat these pans are lighted every morning between seven and eight o'clock; and, in about three hours, the water begins to boil, but is not allowed to continue to do so for more than ten or fifteen minutes. It is kept hot, but not boiling, for about ten hours, and is then allowed to cool gradually, any impurities which rise to the surface being removed by means of

²⁶ See Fitch, *Maldon and the River Blackwater* [1898], pp. 50-51.

²⁷ *Pigot's Directory*, 1826, p. 544.

²⁸ At the Census of 1871, four persons (all, no doubt, in Worraker's employ) were returned as engaged in salt-refining in Essex.

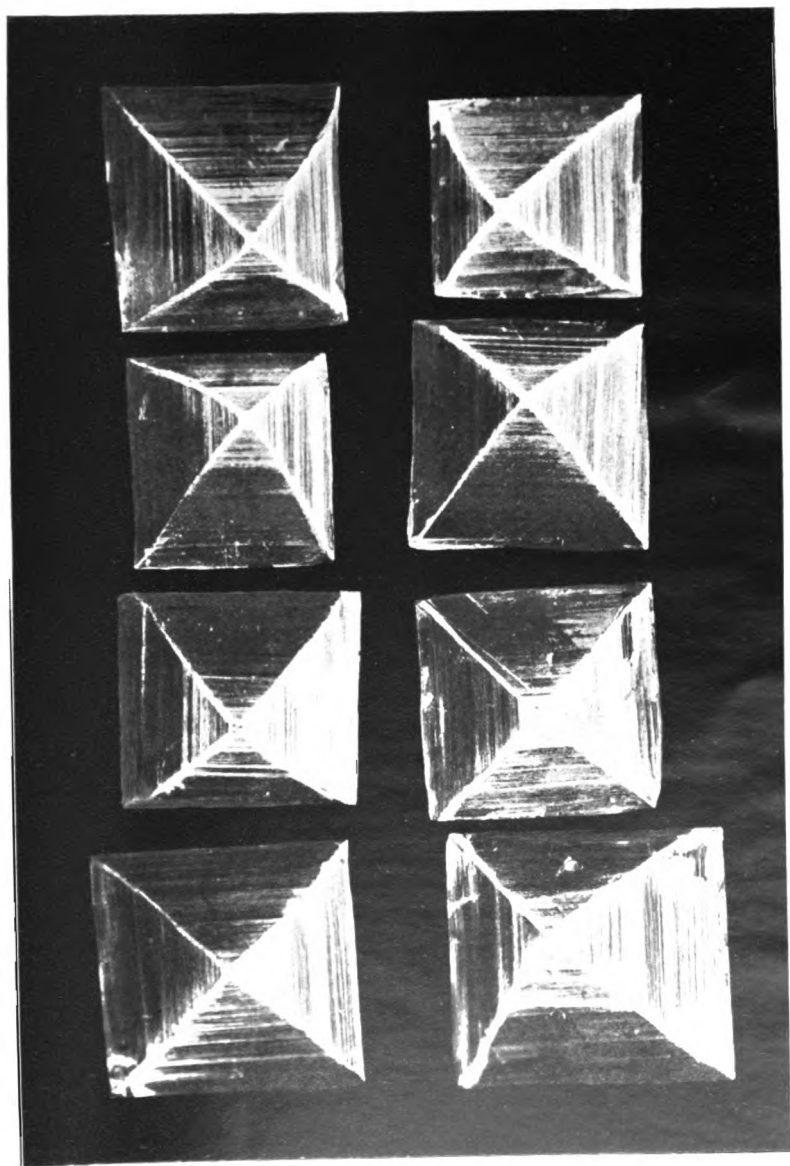


FIG. 4.—SALT CRYSTALS FROM MALDON SALT-WORKS.
(About 1/100 of actual size.)

a brass skimmer. Soon after the water has boiled, salt-crystals begin to form on the surface, in a manner which is most interesting to watch. These crystals (Pl. xxxii) are extremely curious objects—thin, white, shell-like, quadrangular at base, rising in the shape of a pyramid with a truncated cone.²⁹ In size, they vary greatly—some being as much as two inches square: others, equally perfect, no more than one-eighth of an inch. The form is invariable, but the size seems to be determined at the commencement of crystallization; and, after a crystal has started to form, it does not grow. The gentler and shorter the boiling, the finer and more perfect the crystals: violent boiling breaks them into fragments. Such crystals as these are often called “hopper-crystals” (in French, *trémis*). Maxwell Lyte says³⁰ that they tend to form only in still brine. It is said,³¹ too, that the addition of a small quantity of alum to the brine tends to increase their size, but this is not done, I believe, at Maldon. Finally, those crystals which have formed on the surface are skimmed off and set aside for use as the finest table-salt; those lower down are next taken out and used as pickling-salt; while the residue then left in the pan, being less pure, serves for agricultural purposes. This operation is repeated daily, two pans being boiled, the daily yield of salt being about half a ton, or about eighty tons annually.

This output is, of course, insignificant in quantity when compared with that of the Cheshire and Worcestershire rock-salt industry, amounting to hundreds of thousands of tons annually; but, in respect of purity and attractive appearance, Maldon Crystal Salt is far superior to any other produced in Britain, and this enables it to hold its own on the market. Practically, indeed, it reaches the standard of absolute chemical purity, consisting of common salt (chloride of sodium) with an admixture of no more than 0.383 per cent. of other matter, as the following analysis by Dr. A. H. Hassall shows:—

Maldon Crystal Salt Company's Pure Table Salt.

	(100 parts by weight)
Chloride of Sodium	99.617
Chloride of Magnesium	0.198
Sulphate of Magnesium	0.067
Sulphate of Lime	0.118
Total	100.000

²⁹ A salt-crystal forms the trade-mark of the company.

³⁰ Spon's *Cyclopædia*, ii, p. 1710 (1882).

³¹ Thorpe's *Dic. of Applied Chemistry*, iii, p. 436.

Dr. Hassall adds that it is absolutely free from "mechanical impurity and . . . contains a remarkably small proportion of the salts of magnesia, lime, etc." In consequence of this unusual purity, it is in demand among medical men for stimulating the action of the heart. A far smaller quantity is required, either for table or pickling purposes, than of the ordinary salt of commerce, and there is an absence of that bitter after-taste so often noticed in the case of ordinary salt and due to impurities. Further, it is almost completely non-deliquescent—ininitely less so than ordinary salt—owing to the much smaller quantity it contains of chloride of magnesium, which greedily absorbs moisture from the atmosphere. In every respect, therefore, Maldon Salt is superior to ordinary salt.

The Maldon Salt is sold in card-board boxes of varying sizes, and priced from sixpence upward, each box bearing the Company's trade-mark, a salt crystal. It is stocked by some of the largest London shops and stores, and is used at some of the leading London restaurants. In appearance it bears little resemblance to ordinary table-salt, being sold, not in powder, but actually *in crystals*. The larger of these naturally get broken, but many small ones are to be found whole among the mass. For use at table, it requires crushing.

Let us hope that the manufacture of salt at Maldon, small though it is, may long continue to flourish.

[The Club is much indebted to Mr. Christy for the blocks and prints of the three plates illustrating this paper.—ED.]

THE MOSSES OF ESSEX: A CONTRIBUTION TO THE FLORA OF THE COUNTY.

By FRED. J. CHITTENDEN, County Technical Laboratories, Chelmsford.

[Read February 24th, 1906.]

THE Moss Flora of Essex is by no means a rich one, since, at present, the list (excluding the Sphagnaceæ, which formed the subject of a previous communication, see *ESSEX NATURALIST* xiv. (1906) pp. 111-116) includes only about 200 species and sub-species out of a total nearly approaching 600 known to occur within the British Isles. The shortness of this list is due to three principal causes:—

1. The fact that only certain parts of Essex have as yet

been carefully searched. Epping Forest, the district immediately round Chelmsford, the neighbourhoods of Witham, Kelvedon and Saffron Walden are the only parts at all thoroughly explored so far, and even in these some as yet unrecorded species, and especially varieties, will no doubt be discovered. The whole of the eastern coast district in the broadest sense, the Roothings, a large part of North Essex, and the whole of the south from Shoebury to Grays and Purfleet, in which district as the chalk crops up several unrecorded or rare species should be found, have yet to be carefully searched; it is therefore plain that in this direction much remains to be done.

2. The lack of diversity in the soils of Essex is another point of importance, and this, together with the low elevation of the whole of the county, has had a marked effect in lessening the number of species likely to be found, and is a very real cause of a poor Moss Flora.

3. The small rainfall of the county is another real cause not only of a lack of luxuriousness in the growth of the species occurring, but also probably of a smaller number of species being met with than in the west of the country. The arboreal species especially are poorly represented; the trees upon which they usually grow are present, but it is seldom that one finds a moss-grown tree, especially in the neighbourhood of London. This may be due in part to the large amount of acid brought down by the rain in many parts of the county, as Mr. Dymond has pointed out in his paper on "Sulphate of Lime in Essex Soils and Subsoils" (ESSEX NATURALIST, xiv., p. 62).

The fruiting of mosses as a general rule appears to be most abundant where the vegetative development is greatest, and we find, as a rule, much less production of fruit by mosses in Essex than we notice in the moister western parts of the country, where the vegetative growth is more luxuriant. In this connection it is worth noting that a considerable number of those mosses that fail to produce fruit, or that fruit but seldom, frequently form numerous small buds or gemmæ, which are capable of reproducing the plant, as we see in *Tetraphis pellucida*, *Tortula papillosa* and *T. mutica* (the leaves of which, like the last, are frequently covered with numerous round gemmæ), *Orthotrichum lyellii*, *Aulacomnium androgynum*, and to a less extent *A. palustre*, or even reproducing themselves by a piece of leaf which breaks off, as in *Campylopus*

pyriformis, a common moss of the peaty soil of heaths in the county, usually found in tufts covered with the broken leaves.

No species of moss is restricted in its British distribution to Essex, although until recently *Zygodon forsteri* had been found only in this county, at first on a felled tree in Walthamstow at the beginning of the last century; later, on beeches in at least two localities in Epping Forest. It has now been found in two other English counties. It is curious that wherever this moss occurs it is always found in a very scattered fashion, both in this country and on the continent. One would scarcely look for such an alpine species as *Grimmia commutata* in Essex, but Mr. H. N. Dixon found it growing on the roof of a house at Wickham Bishops; perhaps other alpine species may be discovered occasionally in a similar fashion if search is made for them. It was suggested that possibly the spores had been carried by the wind across the North Sea from the mountains of Norway, where the moss is common.

Among species of which there is at present no record for the county, but which should be found here, may be mentioned *Polytrichum urnigerum*, *P. gracile*, *Seligeria paucifolia*, *Ditrichum schreberi*, *Leptodontium flexifolium*, *Encalypta streptocarpa*, *Bryum pendulum*, *B. donianum*, *Mnium stellare*, *Hypnum polygamum*, and *H. lycopodioides*.

Not only is there much to be done in Essex as far as mere species recording goes, but anyone taking up the study of the mosses will find them of much interest in themselves. We have to deal with a series of plants in which the gametophyte generation has reached the fullest development forming the leafy plant, while in all other plants the leafy plant belongs to the sporophyte generation with the sole exception of the nearly allied Hepaticæ. The Musci have followed a line of development of their own, and it has come to an end with the more elaborate of their forms. The manner of obtaining water is full of interest and varies greatly in the different species, affording matter for much study; the form and papillosity of the leaves, the arrangements of lamellæ on the leaf surface, the presence of hair points, etc., are all matters apparently closely connected with the obtaining of an adequate supply of water. The part they play in the economy of Nature, the relation they bear to other forms of life, particularly as formers of soil, and lastly, a subject about which we probably

know least, although of the first importance, the distribution of the various forms according to the soil and situation in which they grow, are among other points of interest. This biological survey should go hand-in-hand with a similar survey of the flowering plants, and the land and freshwater molluscs particularly, but other forms of life should not be ignored. Something has been done in various parts of the world of late on these lines, but nothing so far as I know in Essex.

In the compilation of the following list I have had the kind assistance of, and desire to tender my best thanks to, Mr. W. Cole, through whom I have been able to carefully examine the collections belonging to the Essex Field Club; Mr. A. Gepp, for assistance in consulting the specimens collected by Mr. Forster, now in the Herbarium of the British Museum; Mr. G. Maynard, who kindly compiled a list of mosses collected by Mr. F. Y. Brocas, and now in the Saffron Walden Museum; Mr. W. Sherrin, for the list of mosses collected by himself in Essex; Mr. J. Wheldon, for naming the critical group of *Hypnum* known as *Harpidium*; the Rev. E. N. Blomfield, for additions to the list in the *Victoria History of Essex*; and Mr. H. N. Dixon for lists and much help when in doubt.

The following is a list of the sources from which the information contained in the following list of localities has been derived.

- (1) 1724. RAY, JOHN. *Synopsis Methodica Stirpium Britannicum*, Ed. III.
- (2) 1800. FORSTER, EDWD. Herbarium in the British Museum, Natural History, S. Kensington.
- (3) 1802. SOWERBY, JOHN. *English Botany*.
- (4) 1833. HOOKER, SIR J. *English Botany*, Vol. v.
- (5) 1836. COOPER, DANIEL. *Flora Metropolitana*.
- (6) 1843. SIDEBOTTOM, J. Specimens in Mr. Wilson's Herbarium in the British Museum, Natural History.
- (7) 1845. GREENWOOD, A. "Mosses found near Chelmsford" in the *Phytologist*, Vol. II.
- (8) 1860-1876. VARENNER, E. G. Collection in the Herbarium of the Essex Field Club.
- (9) 1874. BROCAS, F. Y. Collection in the Herbarium of the Saffron Walden Museum.
- (10) 1800-1905. BRAITHWAITE, DR. R. *British Moss Flora*.
- (11) 1885. ENGLISH, J. T. Exsiccata of the Mosses of Epping Forest, in the Herbarium of the Essex Field Club, also many loose specimens collected in the Forest, mostly near Epping.
1886. ENGLISH, J. T. MS. list of the Mosses of Epping Forest.

- (12) 1890. BUXTON, E. N. "Mosses." *Epping Forest*, Ed. III.
[This list was made by Mr. English. Ed.]
- (13) 1890. HOLMES, E. M. Notes in the ESSEX NATURALIST and
some loose specimens in the Herbarium of the Field Club.
- (14) 1898. DIXON, H. N. List of North Essex Mosses in the *Journal of*
Botany, May, 1898.
- 1906. DIXON, H. N. MS. list of additional mosses collected in
Essex.
- (15) 1900. SALMON, E. S. Notes on Essex Mosses in the ESSEX
NATURALIST.
- (16) 1901. READ, MISS E. Mosses collected near Southend in the
Herbarium of the Biological Dept., Technical
Laboratories, Chelmsford.
- (17) 1903. TURNER, E. E. Mosses collected near Coggeshall, in my
own Herbarium.
- (18) 1903. SHENSTONE, J. C. *Victoria History of Essex*. Article
"Botany."
- (19) 1905. SHERRIN, W. R. MS. list of mosses collected in Essex.

The numbers in brackets following the name of a locality in which a moss has been collected correspond with the numbers in brackets in the list of authorities consulted, and indicate the source of the information. Only the first person recording a moss from a certain locality is indicated. The sign ! following a locality indicates that I have examined the specimen upon which the record is based, and the sign !! indicates that I have collected the species in the locality within the past five years.

* This sign prefixed to a species indicates that I have seen fruiting specimens from the county.

The sequence followed is that of the arrangement in the *Students' Handbook of British Mosses*, Ed. II (1904), by H. N. DIXON.

TETRAPHIDACEÆ.

**Tetraphis pellucida* Hedw.

Epping Forest (11) !; Monk Wood (13) !; Theydon Bois (15) !!; nr. Ambresbury Banks (12); nr. Chelmsford (7); Woodham Walter Common (7) !; Little Baddow Common !!

POLYTRICHACEÆ.

**Catharinea undulata* Web. and Mohr.

Epping Forest (11) !; Loughton !!; Mill Green !!; nr. Chelmsford (7); N. Essex (14); Chignal Smealy !!; Little Baddow Common !!; Hazeleigh (13); Braxted (8) !; Felix Hall Shrubbery (8) !; Saffron Walden (9).

**var. minor* Web. and Mohr.

Epping Forest (11) !; Braxted (8) !

C. angustata Brid.

Wickham Bishops (14).

***Polytrichum nanum** Neck.

On the Forest between Nagg's (Hagger ?) lane and the Windmill (2) !; nr. Snaresbrook and nr. the gravelly ride by the south side of Snaresbrook pond (2) !; Walthamstow (2) !; Epping Forest (11) !; Theydon Road (11) !; Lower Forest (11) !; nr. Chelmsford (7); N. Essex (14); Tiptree Heath (8) !

***P. aloides** Hedw.

Epping Forest (12); Mill Green ! !; Galleywood Common (7); gravel pit, Totham (8) !

**var. dicksoni* Wallen.

In gravel pit, Totham (8) !

***P. piliferum** Schreb.

On the Forest (2) !; Epping Forest (11) !; Theydon (15); Warley Common ! !; nr. Chelmsford (7); Danbury ! !; Tiptree Heath (8) !; Osea Is. (13).

***P. juniperinum** Willd.

"On the Forest, gravelly soil with the *piliferum*" (2) !; Epping Forest (11) !; gravel pits by the Wake Arms (12); Warley Common (8) !; nr. Chelmsford (7); Woodham Walter Common (8) !; Totham (8) !; N. Essex (14); Saffron Walden (9).

***P. formosum** Hedw.

Epping Gravel pit (6) !; Epping Forest (11) !; Monk Wood (13) !; South Essex (14); Theydon Bois ! !; Warley Common (8) !; nr. Chelmsford (7); Chalkney Wood (8) !; Pod's Wood (8) !; Woodham Walter Common (8) !; Wickham Bishops (8) !; N. Essex (14).

***P. commune** Linn.

"On the Forest, very common" (2) !; Epping Forest (11) !; Leyton ! !; Theydon Bois ! !; nr. Chelmsford (7); Galleywood Common ! !; N. Essex (14); Woodham Walter Common (8) !; Saffron Walden (9).

var. minus Weis.

Tiptree Heath (8) !

DICRANACEÆ.

**Archidium alternifolium* Schimp.

"On the forest near the great bog near Salter's Buildings" (2) ! ; in a woody part of the forest near Hagger Lane (2) ! The plate in Sowerby's English Botany of this species was drawn from specimens gathered in moist spots upon Epping Forest by Mr. Edwd. Forster. The plate is dated 1st January, 1810.

**Pleuridium axillare* Lindb.

Hagger Lane, Walthamstow (2) ! ; Monk Wood and on banks of a stream crossing the green ride near Debden Slade (13) ; wood near Inworth Church (8) ! ; Saffron Walden (9).

**P. subulatum* Rabenh.

Epping Forest (2) ! ; Lower Forest !! ; Mill Green !! ; Chelmsford (7) ; Witham (8) ! ; Braxted (8) ! ; Saffron Walden (9).

**P. alternifolium* Rabenh.

Totham (8) ! ; Braxted (8) ! ; Kelvedon (8) !

**Ditrichum homomallum* Huepe.

Mile End, Colchester (8) !

Seligeria calcarea Br. and Schimp.

Saffron Walden (9).

**Ceratodon purpureus* Brid.

On the Forest (2) ! ; in gravelly soil on the Forest near High Beach (2) ! ; Epping Forest (11) ! ; Warley Common !! ; near Chelmsford (7) !! ; Galleywood Common !! ; Norton Heath !! ; Rivenhall (8) ! ; N. Essex (14) ; Kelvedon (8) ! ; Little Baddow Common !! ; Osea Island (13) ; Hatfield Forest (13) ; Saffron Walden (9).

**Dicranella heteromalla* Schimp.

"In a ditch near Snaresbrook Pond" (2) ! ; near Hale Banks, Walthamstow (2) ! ; Epping Forest (11) ! ; Monk Wood, Epping Forest (13) ! ; Leyton !! ; Loughton !! ; Theydon !! ; Warley Common (8) ! ; Mill Green Common !! ; nr. Chelmsford (7) ; Linguard Common !! ; banks, Woodham Walter (8) ! ; Little Baddow Common (8) ! ; Braxted (8) ! ; Pod's Wood (8) ! ; Saffron Walden (9).

***D. cerviculata** Schimp.

"On the forest near Wanstead Park in a gravel pit" (2)! All the specimens in Mr. Varenne's collection labelled as belonging here appertain to the last species.

***D. rufescens** Schimp.

"Side of clay pits, Epping Plain, scarce, easily overlooked from its small size and colour" (11)!

***D. varia** Schimp.

Pond near Barnes' Mill. Springfield (7); Kelvedon (8)!; in a field near Newport, Essex (2)!; Saffron Walden (9).

**var. tenuifolia* Br. and Schimp.

Little Hale Bushes, Walthamstow (2)!

***Dicranoweisia cirrata** Lindb.

"On the rails in our garden," Walthamstow (2)!; "on the bottom of an oak tree in a field in Hoe Street, Walthamstow" (2)!; High Beach (11)!!; Moreton (14); nr. Chelmsford (7); Broomfield!!; Kelvedon (8)!; N. Essex (14); Hatfield Forest (13); Saffron Walden (9).

***Campylopus flexuosus** Brid.

Epping Forest (11)!; Loughton!!; nr. Chelmsford (7).

***C. pyriformis** Brid.

"On the forest not far from Chingford Hatch" (2)!; very uncertain, cropping up in quantities after the felling of timber trees (11)!; Monk Wood (13); Theydon!!; Galleywood Common!!; Linguard Common!!; N. Essex (14); Little Baddow Common (8)!; Wood near Woodham Walter (8)!

C. fragilis Br. and Schimp.

Chantrey Wood (8)!

Dicranum fuscescens Turn.

Epping Forest (12). I have seen no specimens.

D. bonjeani De Not.

"On the forest near Snaresbrook and Hale Banks" (2)!; Epping Forest (11)!; Loughton!!; Mill Green Common!!; Galleywood Common!!; Woodham Walter Common (8)!; Tiptree Heath!!; West Bergholt Heath (8)!

***D. scoparium** Hedw.

On the forest (2) ! ; Leyton !! ; Loughton !! ; Mill Green Common !! ; Carpenter's Wood, Southend (16) ! ; near Chelmsford (7) ; N. Essex (14) ; Gt. Totham (8) ! ; Wood near Woodham Walter (8) ! ; Saffron Walden (9).

**var. orthophyllum* Brid.

Tiptree Heath (8) ! ; wood at Wickham Bishops (8) !

D. majus Turn.

Monk Wood, Epping Forest (13) !

***Leucobryum glaucum** Schimp.

On open parts of the forest (2) ! ; Epping Forest (11) ! ; Loughton ! ! ; wood near Warley Barracks (8) ! ; near Chelmsford (7) ; N. Essex (14) ; Tiptree Heath (8) ! ! ; wood near Woodham Walter (8) !

Mr. English recorded this species as in fruit in Epping Forest, but the fruit on all his specimens belongs to *Webera nutans* which was mixed with the *Leucobryum*. In ESSEX NATURALIST, VI. (1881), Mr. Waller, of Tottenham, records the fruiting of this species in the forest. I have seen no fruiting specimen from the county.

FISSIDENTACEÆ.

***Fissidens exilis** Hedw.

"In a damp shady place on a clay soil on the forest" (2) ! ; Hangboy Slade, Epping Forest (15) ; Kelvedon Hall Woods (8) !

***F. viridulus** Wahl.

N. Essex (14) ; Braxted (8) ! ; Hatfield Forest (13) ; Kelvedon (8) !

***F. pusillus** Wils.

Kelvedon (8) ! ; Great Tey (8) !

***F. incurvus** Stark.

N. Essex (14) ; Bank near Kelvedon Hall Wood (8) !

***F. bryoides** Hedw.

In hedges and woods, Epping Forest, common (2) ! ; Pilgrim's Hatch, Brentwood ! ! ; Galleywood Common ! ! ; nr. Chelmsford (7) ; Boreham ! ! ; N. Essex (14) ; Kelvedon (8) ! ; Coggeshall (17) ! ; Saffron Walden (9).

***F. crassipes** Wils.

By side of a ditch, Kelvedon (8)!

***F. adiantoides** Hedw.

In a long bog on the forest near High Beach and the King's Oak (2) !; Galleywood Common (7) !!; Hatfield Forest (13) !; Saffron Walden (9).

***F. taxifolius** Hedw.

On the Forest (2) !; Hazeleigh (13); Writtle !!; Chelmsford (7) !!; Broomfield !!; N. Essex (14); Braxted !!; Kelvedon (8) !; Coggeshall (17) !; Earls Colne !!; Hatfield Forest (13); Saffron Walden (9).

GRIMMIACEÆ.

***Grimmia apocarpa** Hedw.

Nr. Chelmsford (7); wall, Kelvedon (8) !!; wall, Witham (8) !; on the bottom of a tree, Rivenhall (8) !; Saffron Walden (9).

***G. pulvinata** Smith.

Walthamstow (2) !; Epping Forest (11) !; wall, Epping (11) !; nr. Chelmsford (7); Broomfield !!; Springfield !!; Chignal Smealy !!; N. Essex (14); Kelvedon (8) !!; Dovercourt (19) !; Hatfield Forest (13); Saffron Walden (9).

G. commutata Hub.

Tiled roof at Wickham Bishop's (14).

Rhacomitrium canescens var. *ericoides* Br. and Schimp.

Tiptree Heath (8) !

TORTULACEÆ.

***Acaulon muticum** C. Muell.

On a bank in the lane from Hoe Street to Markhouse Field, Walthamstow (2) !; nr. Chelmsford (7); Saffron Walden (9).

***Phascum cuspidatum** Schreb.

Epping Forest (11) !; Walthamstow (2) !; nr. Chelmsford (7) !!; Broomfield !!; N. Essex (14); Kelvedon (8) !; Dovercourt (19) !; Saffron Walden (9).

*var. *schreberianum* Brid.

Nr. Wicken Bonhunt (2) !

***P. curvicolle** Ehrh.

Nr. Chelmsford (7); Audley End (10).

**Pottia recta* Mitt.

Saffron Walden (9).

**P. heimii* Furnr.

Dovercourt (19) ! ; nr. Manningtree (8) ! ; Alresford Creek (8) !

**P. truncatula* Lindb.

Walthamstow (2) ! ; Epping Forest (11) ! ; Norton Heath ! ! ; nr. Danbury ! ! ; nr. Chelmsford (7) ; Hazeleigh (13) ; N. Essex (14) ; Broomfield ! ! ; Writtle ! ! ; Kelvedon (8) ! ; Tiptree Heath (8) ! ; Mark's Hall ! ! ; Hatfield Forest (13) ; Saffron Walden (9).

**P. intermedia* Furnr.

On Epping Forest between Hagger Lane, Walthamstow, and the house where the windmill formerly stood (2) ! ; nr. the great bog by Salter's buildings (2) ! ; Carpenter's Wood, Southend (16) ! ; N. Essex (14) ; Broomfield ! ! ; Kelvedon (8) !

**P. wilsoni* Br. and Schimp.

Nr. Wivenhoe (8) !

**P. minutula* Furnr.

Westcliff (16) ! ; Rainsford End, Chelmsford ! ! ; N. Essex (14) ; Braxted (8) ! ; Kelvedon (8) !

**P. starkeana* Mull.

Kelvedon (8) ! ; Feering (8) !

**P. lanceolata* C. Muell.

On a bank between Quendon and Newport (2) ! ; Feering (8) ! ; Kelvedon (8) ! ; Yeldham (8) ! ; nr. Chelmsford (7) ; Saffron Walden (9).

**Tortula pusilla* Mitt.

Kelvedon (8) ! ; Rivenhall (8) ! ; Saffron Walden (9).

**T. rigida* Schrad.

Chalk pits, Purfleet (9) ! ; near Chelmsford (7).

**T. ambigua* Angstr.

Kelvedon (8) !

**T. aloides* De Not.

Kelvedon (8) ! ; near Halstead (8) ! ; near Yeldham (8) !

[T. atrovirens Lindb.

This species is recorded for Essex in the *Victoria History of Essex*, probably on the strength of a specimen so labelled in Mr Varenne's collection; but this is a species of *Pottia*. The record must therefore be considered unconfirmed.]

***T. cuneifolia Roth.**

Near Springfield (7) !; Military Road, Colchester (8) !; near W. Bergholt (8) !; near Wivenhoe (8) !

***T. marginata Spruce.**

Kelvedon (8) !

***T. muralis Hedw.**

On walls, very common (2) !; Epping Forest (11) !; Leyton !!; near Chelmsford (7) !; N. Essex (14) ; Kelvedon (8) !!; Stisted !!; Broomfield !!; Dovercourt (19) ; Saffron Walden (9).

var. aestiva Brid.

Kelvedon (8) !; Nayland (8) !

***T. subulata Hedw.**

Epping Forest (12) ; near Chelmsford (7) ; Broomfield !!; N. Essex (14) ; Wickham Bishops !!; Kelvedon (8) !; Dovercourt (19) !; near Quendon (2) !; near Henham (2) !; Saffron Walden (9).

***T. mutica Lindb.**

Cobbin's Brook (11) !; nr. Chelmsford (7) ; Rainsford End !!; Writtle !!; Boreham !!; Wickham Bishops (14) ; Notley (8) !; Kelvedon (8) !; nr. Bures (8) !

***T. laevipila Schwaegr.**

Trees, Walthamstow (2) !; Epping Forest (11) !; Hazeleigh (13) ; N. Essex (14) !; nr. Chelmsford (7) ; Pleshey !!; Braxted (8) !; Stisted !!; Kelvedon (8) !; Hatfield Forest (13) ; Saffron Walden (9).

***T. intermedia Berk.**

Chelmsford !!; Kelvedon Church (8) !!; Little Greenstead Church (14).

***T. ruralis Hedw.**

Tiles, Walthamstow (2) !; on the ground in a gravel pit between Woodford and Chingford Hatch (2) !; N. Essex (14) ; Kelvedon (8) !; Feering (8) !

T. ruraliformis Dixon.

Dovercourt (19).

T. papillosa Wils.

Witham (14); Wickham Bishops (14) !!; Inworth (8)!

Barbula lurida Lindb.

Sea cliffs, Southend (7).

***B. rubella** Mitt.

Epping Forest (11) !; on a tree by the side of Blackwall Chase off the Hare and Hounds Inn, Roxwell (7); Inworth (8) !; near Halstead (8) !; Saffron Walden (9).

B. tophacea Mitt.

N. Essex (14).

***B. fallax** Hedw.

Epping Forest (11) !; nr. Chelmsford (7); N. Essex (14); Broomfield !!; Braxted (8) !; Kelvedon (8) !; Tiptree Heath (8) !; Yeldham (8) !; Dovercourt (19); Saffron Walden (9).

var. brevifolia Schultz.

In a lane between Hall Lane and Grove Lane, Henham (2) !; on a bank between Ugley and Quendon near the 35-mile stone (2) !; Dovercourt (19).

***B. rigidula** Mitt.

Wall, Little Bardfield (14).

***B. cylindrica** Schimp.

Nr. Chelmsford (7); N. Essex (14); Yeldham (8) !

B. sinuosa Braithw.

Wickham Bishops (14).

B. hornschurchiana Schultz.

Wall of Colchester Castle (8) !

B. revoluta Brid.

Oyn's Brook Bridge (8) !; Kelvedon Church wall (8) !!; Saffron Walden (9).

***B. convoluta** Hedw.

On the Forest near Hale End (2) !; in fields near Quendon and Newport (2) !; Saffron Walden (9).

***B. unguiculata Hedw.**

On a wall, Greenleaf Lane (2)!; on a wall between Northfields, Hoe Street and the garden of Mr. White's house, Walthamstow (2)!; Epping Forest (11)!; N. Essex (14); nr. Chelmsford (7)!; Kelvedon and Copford (8)!; Dovercourt (19); nr. Quendon (2)!; nr. Rickling (2)!; nr. Widdington (2)!

var. cuspidata Braithw.

Rainsford End, Chelmsford !!; Marks Tey (8)!

var. apiculata Braithw.

On the forest near Hale End and on banks, not uncommon (2)!; near Wicken Bonhunt (2)!

***Weisia crispa Mitt.**

Near Chelmsford (7); Kelvedon (8)!; Saffron Walden (9).

***W. microstoma C. Muell.**

Inworth (8)!; near Sible Hedingham (8)!

***W. viridula Hedw.**

On a bank in a lane leading from Hoe Street to Markhouse field and in the lane leading from Hoe Street to Mr. Biggs', Great House (2)!; Forest near the great Bog (2)!; near Hale End (2)!; Coopersale (11)!; Writtle!!; near Chelmsford (7); Kelvedon (8)!; Saffron Walden (9).

***W. mucronata Br. and Schimp.**

Near Halstead (8)!

Cinclidotus brebissoni Husn.

On a tree in the meadows, Widford (8!; Writtle!!; Great Bardfield (8)!

Encalypta vulgaris Hedw.

"Bryum erecta capitulis, calyptra laxa conica, foliis serpilli pellucidis angustioribus. Observed by Mr. Vernon in Essex at Sir Thomas Middleton's House." Mr. Fitch informs me that in Ray's time Sir Thomas Middleton's House was Stanstead Hall. This quotation from Ray's Synopsis, Ed. III., is the only record I am able to find of the occurrence of this species in the county.

ORTHOTRICHACEÆ.

Zygodon viridissimus R. Br.

In my garden, Hoe Street, Walthamstow (2) ! ; on a hornbeam, Epping Lower Forest (11) ! ; nr. Chelmsford (7) ; N. Essex (14) ; Hatfield Forest (13) ; Inworth (8) ! ; Rivenhall (8) ! ; Easthorpe (8) ! ; Ugley Holes (2) !

Z. conoideus Hook. and Tayl.

Epping Forest (11) ! ; on a tree, Kelvedon (8) !

Z. forsteri Wils.

On a felled tree in a timber yard at Chapel End, Walthamstow (2) ! (this tree was probably brought from Epping Forest) ; Monk's Wood (13) ; on beeches near the Wake Arms (14).

[*Ulota bruchii* is recorded in the *Victoria History of Essex*, probably on the strength of the specimen so named in Mr. Varenne's collection, but that specimen belongs to the next species.]

***U. crispa** Brid.

On trees and bushes on the forest between Loughton and Debden Green (2) ! ; on an oak, Ongar Park (11) ! ; Chantry Wood (8) ! ; near Chelmsford (7) ; Felix Hall Shrubbery (8) ! ; Great Tey (8) ! ; Mile End, Colchester (8) ! ; wood near Colchester (7) ! ; Saffron Walden (9).

Orthotrichum rupestre Schleich.

Saffron Walden (9).

***O. anomalum** var. *saxatile* Milde.

Wall of garden, Walthamstow (2) ! ; on a tree in the meadows, Kelvedon (8) ! ; Feering (8) ! ; tiles on an old barn near Halstead (8) ! ; Roman Wall, Colchester (8) ! ; on a stone by the water in Hatfield Forest (8) ! ; Saffron Walden (9).

***O. leiocarpum** Br. and Schimp.

Walthamstow (2) ! ; near Chelmsford (7) ! ; near Halstead (8) ! ; Saffron Walden (9).

O. lyellii Hook and Tayl.

Epping Forest (14) ; Wickham Bishops (14) ; Felix Hall Wood (8) ! ; tree in a wood at Copford (8) ! ; wood at Messing (8) !

O. affine Schrad.

On oak and poplar side of Cobbin's Brook (11) ! ;
 Writtle !! ; N. Essex (14) ; near Chelmsford (7) ;
 Wickham (8) ! ; Kelvedon (8) ! ; Alresford (8) ! ;
 Hatfield Forest (13) ; Saffron Walden (9).

O. sprucei Mont.

Old pales near the Chelmer, Chelmsford (8) !

[**O. stramineum** has been recorded in the *Victoria History* as occurring in the county, but I cannot find any specimens of the true plant.]

***O. schimperi** Humm.

Near Chelmsford (7) ; Kelvedon (8) !

***O. tenellum** Br.

Kelvedon (8) ! ; Feering (8) ! ; Pod's Wood (8) ! ;
 Lyston (8) !

***O. pallens** Br.

Ash tree, Kelvedon (8) !

***O. diaphanum** Schrad.

Epping Forest, on a beech (11) ! ; Walthamstow (2) ! ;
 near Chelmsford (7) ! ! ; Writtle ! ! ; Broomfield ! ! ;
 Rivenhall (8) ! ; N. Essex (14) ; Kelvedon (8) ! ;
 Hatfield Forest (13) ; Saffron Walden (9).

FUNARIACEÆ.

***Ephemerum serratum** Hampe.

On the Forest near the great bog near Salter's
 buildings (2) ! ; Epping Forest (12) ; N. Essex (14) ;
 Kelvedon (8) ! ; Braxted (8) !

**var. angustifolium* Br. and Schimp.

Broomfield ! !

***Physcomitrella patens** Br. and Schimp.

Hazeleigh (13) ; Kelvedon (8) !

***Physcomitrium pyriforme** Brid.

Walthamstow (2) ! ; Epping Forest (11) ! ; Plaistow
 Levels (2) ! ; near Chelmsford (7) ! ! ; Osea Island (13) ;
 N. Essex (14) ; Kelvedon (8) ! ; river side, Braxted (8) ! ;
 Saffron Walden (9).

**Funaria fascicularis* Schimp.

"On the edge of a ditch running from a spring on the forest between Snaresbrook and Shrub bush" (2) ! ; near Chelmsford (7) ; Galleywood Common !! ; Kelvedon, Langford, etc., on gravel and clay (8) ! ; Halstead (8) !

◊*F. hygrometrica* Sibth.

"In garden, waste ground," Walthamstow (2) ! ; "on a bank in the lane leading from Hoe Street to Markhouse field," Walthamstow (2) ! ; Epping Forest, abundant where fires have been (11) ! ; N. Essex (14) ; near Chelmsford (7) ; Galleywood Common !! ; Hatfield Peverel !! ; Kelvedon (8) ! ; Dovercourt (19) ; Saffron Walden (9).

**var. calvescens* Br. and Schimp.
Chelmsford !!

MEESIACEÆ.

**Aulacomnium palustre* Schwaegr.

"On the forest between Chingford Hatch and Woodford Road" (2) ; "near Chingford Hatch with gemmæ" (2) ! ; in the moist parts of the forest, common (11) ! ; Epping Forest (2) ! ; Theydon (15) ; Loughton !! ; Warley Common (8) !! ; Galleywood Common (8) !! ; N. Essex (14) ; N. Weald !! ; Linguard Common !! ; Woodham Walter (8) ! ; Tiptree Heath (8) !! ; West Bergholt Heath (8) !

This moss is a constant companion of most species of *Sphagnum* in the county but appears to fruit but rarely, the only fruiting specimen I have been able to find having been collected by Mr. English in the bog near the Wake Arms.

**A. androgynum* Schwaegr.

"In the gravel pits near Forest House and on the bank near Low Leyton" (2) ! ; Epping Forest, frequent in hollows in the trunks of pollard hornbeams (10) ; side of Theydon Road and Hill Hall Wood (11) ! ; N. Weald !! ; N. Essex (14) ; Writtle !! ; Little Baddow Common !! ; Totham, on gravelly banks (8) ! ; inside an old decayed willow trunk, Feering (8) ! ; near Wivenhoe (8) !

This moss is usually found bearing gemmæ ; very rarely in fruit.

BARTRAMIACEÆ.

***Bartramia pomiformis** Hedw.

By the roadside between Woodford Wells and the Bald-faced Stag (2) !; Epping Forest (11) !; side of the Theydon Road (11) !; N. Essex (14) ; near Chelmsford (7) ; Hatfield Peverel (14) !!; Springfield !!; Little Waltham !!; Woodham Walter !!; Great Totham (14) ; Tiptree (14) ; Pod's Wood Lane (8) !; Stanstead (2) !

***Philonotis fontana** Brid.

Epping Forest (11) !; Theydon Bois and Loughton Road (11) !; near Chelmsford (7) ; Galleywood Common (8) !!; West Bergholt Heath (8) !

BRYACEÆ.

***Leptobryum pyriforme** Wils.

N. Essex (14) ; Chelmsford !!; on the brick of a culvert, Feering (8) !

***Webera nutans** Hedw.

Old gravel pits and damp heaths, Epping Forest (11) !; Epping Lower Forest (11) !; Leyton !! Theydon !!; wood near Warley (8) !; nr. Chelmsford (7) !!; Woodham Walter Common (8) !; Braxted (8) !

***var. longiseta** Br. and Schimp.

Epping Forest (11) !

***W. annotina** Schwaegr.

"In woods, fallow fields, &c., and barren in shady places in the garden, Walthamstow" (2) ! "In this species are a number of red substances like berries in the alæ of the leaves and about the stalk. They first appeared bright green." Edwd. Forster.

Mr. English says "found in damp places in the Stump Road, Epping Lower Forest, fruit scarce," but all the specimens I have seen of his collecting so labelled belong to *W. nutans*.

***W. carnea** Schimp.

Hale End (2) !; "on a tree near the great bog on the Forest" (2) !; Theydon (11) !; Hazeleigh (13) ; pond near Barnes' Mill, Springfield (7) ; Pleshey !!; Kelvedon (8) !; Marks Hall (8) !

W. albicans Schimp.

Dovercourt and Wrabness (19).

[**Bryum pendulum** Schimp. is recorded for Essex in the *Victoria History*, but I have seen no specimens. It is a species that should be looked for.]

B. pallens Sw.

N. Essex (14).

***B. inclinatum** Bland.

Kelvedon and Tiptree Heath (8) !

***B. pseudotriquetrum** Schwaegr.

"In a bog on the forest between Salter's buildings and the Windmill (now Windmill Cottage)" (2) ! ; Epping Forest (12) ; Ewell Hall, Kelvedon, habitat now destroyed (8) !

***B. bimum** Schreb.

Bog on Galleywood Common (7) ! ! ; damp place near Kelvedon (8) !

***B. affine** Lindb.

Cook's wall, Kelvedon (8) ! ; Tiptree (8) ! ; Brightlingsea Common (8) !

***B. intermedium** Brid.

Coopersale Forest, local (11) ! ; N. Essex (14) : Kelvedon (8) ! ; Bradley Wood (8) ! ; Wrabness (19).

***B. caespitium** Linn.

"Under the pump in our garden", Walthamstow (2) ! ;
"on walls and on the ground, common, Walthamstow"
(2) ! ; Epping Forest (11) ! ; Kelley's wall, Epping (11) ! ;
N. Essex (14) ; near Chelmsford (7) ; Springfield ! ! ;
Kelvedon (8) ! ; Pod's Wood (8) ! ; trunks of felled trees
Inworth (8) ! ; on culvert, Beckingham (8) ! ; Saffron
Walden (9).

***B. capillare** Linn.

"On a bank in a hedge, High Beach" (2) ! ; Epping
Forest (11) ! ; Rifle ball bank, High Beach (11) ! ;
Pilgrim's Hatch, Brentwood ! ! ; N. Essex (14) ; near
Chelmsford (7) ! ! ; Broomfield ! ! ; Kelvedon (8) ! ;
Inworth (8) ! ; Osea Island (13) ! ; Hatfield Forest (13) ! ;
Saffron Walden (9).

***B. erythrocarpum** Schwaegr.

Forest near Hale End (2)!; garden walls, Epping Forest (11)!; N. Essex (14); Broomfield!!

***B. atropurpureum** Web. and Mohr.

Epping Forest (11)!; near Chelmsford (7); wood near Wickham Bishops (8)!; Kelvedon (8)!; Dovercourt (19); Saffron Walden (9).

***B. murale** Wils.

Epping, on walls (11)!; garden wall, Rivenhall (8)!; Roman wall, Colchester (8)!; church wall, Kelvedon (8)!

***B. argenteum** Linn.

"On the forest near Golder's Hill" (2)!; Epping Forest (11)!; Theydon Bois (11)!; N. Essex (14)!; near Chelmsford (7); Kelvedon (8)!; Harwich (19); Saffron Walden (9).

B. roseum Schreb.

Near Chelmsford (7).

Minum affine Bland.

Saffron Walden (9).

var. elatum Br. and Schimp.

Bog, Theydon Bois (11)!

M. cuspidatum Hedw.

"Among bushes on the forest near Whipp's Cross and elsewhere" (2)!; N. Essex (14); gravel pit near Springfield Gaol (7).

***M. rostratum** Schrad.

Epping Forest (11)!; Lower Forest!!; N. Essex (14); Chignal!!; Kelvedon (8)!; Felix Hall Shrubbery (8)!; Copford (8)!; Hatfield Forest (13)!; Saffron Walden (9).

***M. undulatum** Linn.

"Among bushes in Clay Street and in the second field we had in Wood Street when we lived there" (2)!; Epping Forest (13)!; Monk Wood (11)!!; Epping Lower Forest (12); N. Essex (14); nr. Chelmsford (7); Chignal!!; Broomfield!!; Little

Baddow !!; Woodham Walter Common (8) !; Hazleigh (13); Kelvedon (8) !; Hatfield Forest (13) !; Saffron Walden (9).

***M. hornum** Linn.

"On Ambrs. banks, the old camp near Epping" (2) !; in the woody part of the forest near Hagger Lane in shady places (2) !; Epping Forest (11) !; Monk Wood (13) ! !; Warley Common ! !; Pilgrim's Hatch ! !; Norton Heath ! !; Mill Green ! !; N. Essex (14); nr. Chelmsford (7); Danbury ! !; Carpenter's Wood, Southend (16) !; Pod's Wood Lane (8); Saffron Walden (9).

M. punctatum Linn.

"On the Forest beyond Loughton" (2) ! !; Epping Forest (11) !; nr. Loughton (11) !; "in Hainault Forest between Chigwell Row and Bourn Bridge" (2) !; nr. Chelmsford (7); Brook bank, Chedingsell Grange Farm (8) !; Saffron Walden (9).

***M. subglobosum** Br. and Schimp.

Epping Forest (11) !; Epping Lower Forest (11) !; Galleywood Common ! !; Woodham Walter Common (7).

FONTINALACEÆ.

***Fontinalis antipyretica** Linn.

Epping Forest (11) !; N. Essex (14); nr. Chelmsford (7); Springfield ! !; pond in Allshott's Farm, Kelvedon (8) !

CRYPHÆACEÆ

***Cryphæa heteromalla** Mohr.

"On a maple tree in Loughton Street near the small mound that croses (?) the road" (2) !; near Chelmsford (7); White Notley (8) !; Kelvedon (8) !; on trees near Shortgrove, near Newport (2) !; Saffron Walden (9).

NECKERACEÆ

Neckera pumila Hedw.

Loughton Forest (13); on hornbeams, Epping (7); Saffron Walden, very sparingly (9).

N. complanata Hubn.

Epping Forest, principally on hornbeam and maple (11) ! ; Monk Wood (13) ; N. Essex (14) ; near Chelmsford (7) ; Broomfield ! ! ; Pleshey ! ! ; trees, Prested Hall Wood (8) ! ; Saffron Walden (9).

***Homalia trichomanoides** Brid.

In a thicket near Chingford lane on the Forest (2) ! ; in a wood near a footpath from Hale End to Chapel End (2) ! ; Crane's Brook, Epping Forest (11) ! ; near Chelmsford (7) ; N. Essex (14) ; Kelvedon (8) ! ; Rivenhall (8) ! ; Saffron Walden (9).

HOOKERIACEÆ.

Pterygophyllum lucens Brid.

In a boggy thicket near Warley Common (2) !

LEUCODONTACEÆ.

***Leucodon sciuroides** Schwaegr.

"On the trees in the forest near Chingford Hatch, and elsewhere" (2) ! ; on maple trees, Lower Forest, scarce (11) ! ; nr. Chelmsford (7) ; Hazeleigh (13) ; N. Essex (14) ; Pleshey ! ! ; trees, Messing (8) ! ; Saffron Walden (9).

Antitrichia curtipendula Brid.

"On a tree in the forest between the Ball-faced stag and Muncombe," (Monkhams ?) (2) ! ; Saffron Walden (9).

***Porotrichum alopecurum** Mitt.

Epping Forest (11) ! ; nr. Chelmsford (7) ; N. Essex (14) ; Coggeshall (17) ; Broomfield ! ! ; Kelvedon (8) ! ; near the east pales of Shortgrove, near Newport (2) ! ; Widdington (2) ! ; Chickney (2) ! ; Saffron Walden (9).

LESKEACEÆ.

***Leskea polycarpa** Ehrh.

Side of Cobbins brook, Epping (11) ! ; N. Essex (14) ! ; Writtle ! ! ; Broomfield ! ! ; Kelvedon (8) ! ; Saffron Walden (9).

***Anomodon viticulosus** Hook. and Tayl.

Hale End (2) ! ; Epping Forest (11) ! ; "on a birch in a lane near Nazing Church" (2) ! ; Chelmsford ! ! ;

Broomfield !! ; N. Essex (14) ; Chignal !! ; Roxwell !! ;
 Little Boyton Hall Farm (7) ; Pleshey !! ; Kelvedon
 (8) ! ; Hatfield Forest (13) ! ; Saffron Walden (9).

Leptodon Smithii Mohr.

"Gathered by Mr. Dillwyn near Walthamstow" (3) ;
 this specimen was figured in British Botany (1804).

Thuidium abietinum Br. and Schimp.

Saffron Walden on chalk ridges and in chalk pits along
 with *Hyphnum molluscum* (9).

***T. tamariscinum** Br. and Schimp.

"On the forest very common but seldom seen in fruit"
 (2) ! ; Epping Forest (11) ! ; Loughton !! ; Hazeleigh
 (13) ; near Chelmsford (7) ; Mill Green !! ; N. Essex (14) ;
 Little Baddow !! ; Woodham Walter !! ; Lingard
 Common !! ; Braxted (8) ! ; Earls Colne !! ; Hatfield
 Forest (13) ; Saffron Walden (9).

HYPNACEÆ.

Climacium dendroides Web. and Mohr.

Near the shore below Southend (2) !

***Pylasia polyantha** Br. and Schimp.

Elm tree, Ewell Hall, Kelvedon (8) !

***Isothecium myurum** Brid.

Epping Forest (12) ; near Chelmsford (7) ; N. Essex
 (14) ; Little Baddow !! ; Kelvedon (8) !

***Pleuropus sericeus** Dixon.

"On the forest" (2) ! ; "principally on elm trunks,
 especially prostrate ones" (11) ! ; near Chelmsford (7) !! ;
 N. Essex (14) ; Writtle !! ; Chignal !! ; Braintree !! ;
 Kelvedon (8) ! ; Earls Colne !! ; Dovercourt (19) ; Hat-
 field Forest (13) ; Saffron Walden (9),

***Camptothecium lutescens** Br. and Schimp.

Southend (2) ! ; near Chelmsford (7) ; N. Essex (7) ;
 Kelvedon (8) ! ; Saffron Walden (9) ; Wicken Bonhunt
 (2) !

Brachythecium salebrosum var. *palustre* Schimp.

Wrabness (19).

B. glareosum Br. and Schimp.

Saffron Walden (9).

***B. albicans** Br. and Schimp.

On the forest near Hale End, Walthamstow (2) ! ; near Chelmsford (7) ; Osea Island (13) ; N. Essex (14) ; Maldon (19) ; Danbury !! ; Norton Heath !! ; Donyland Heath (8) ! ; Wivenhoe (8) ! ; Dovercourt (19) ; Saffron Walden (9).

***B. rutabulum** Br. and Schimp.

In a wood near Hale End (2) ! ; Epping Forest (11) ! ; Galleywood Common !! ; Chelmsford (7) !! ; Prittlewell (16) ! ; N. Essex (14) ; Kelvedon (8) ! ; Inworth (8) ! ; Cressing Temple (8) ! ; Woodham Walter !! ; Tiptree Heath !! ; Wickham (8) ! ; Saffron Walden (9).

***B. rivulare** Br. and Schimp.

Cobbins brook, on prostrate trunks submerged (11) ! ; Hatfield Forest (13) ; Chalkney Wood (8) !

***B. velutinum** Br. and Schimp.

Walthamstow (2) ! ; Epping Forest (11) ! ; Coopersale (11) ! ; nr. Chelmsford (7) ; Writtle !! ; Broomfield !! ; N. Essex (14) ; Woodham Walter !! ; Kelvedon (8) ! ; Dovercourt (19) ; Hatfield Forest (13) ! ; Saffron Walden (9).

B. populuem Br. and Schimp.

Saffron Walden (9).

B. plumulosum Br. and Schimp.

Nr. Chelmsford (7) ; Saffron Walden (9).

B. illecebrum DeNot.

" In open parts of Epping Forest " (2) ; Little Baldow Common (7) !

***B. purum** Dixon.

" In hedges and in woods, Epping Forest " (2) ! ; Monk Wood (11) ! ; Loughton !! ; Ramsden Heath (7) ; Hazeleigh (13) ; Southend (16) ; Galleywood Common !! ; N. Essex (14) ; Kelvedon (8) ! ; Broomfield !! ; Hatfield Forest (13) ! ; Saffron Walden (9).

Eurhynchium piliferum Br. and Schimp.

Mattham's Lane and Crane Wood, Epping (11) ! ; N. Essex (14) ; Bligh's Wood, Springfield (7) ; Kelvedon (8) ! ; Donyland Heath (8) ! ; Colne, near Wivenhoe (8) ! ; Hatfield Forest (13) ; Saffron Walden (9) .

E. crassinervium Br. and Schimp.

Hatfield Forest (13); Saffron Walden (9).

***E. praelongum** Br. and Schimp.

Near Loughton, very common in hedges (2) !; Epping Forest (11) !; Loughton !!; Mill Green Common !!; near Chelmsford (7); Prittlewell (16) !; Hazeleigh (13) !; Osea Island (13); N. Essex (14); Broomfield !!; Pleshey !!; Kelvedon (8) !; Dovercourt (19); Hatfield Forest (13); Saffron Walden (9).

***E. swartzii** Hobk.

Epping Forest (11) !; Hazeleigh (13); Broomfield !!; Kelvedon (8) !; Rickling (2) !; Wicken Bonhunt (2) !; Saffron Walden (9).

***E. pumilum** Schimp.

Kelvedon, Inworth and Aldham (8) !; Hatfield Forest (13).

***E. tenellum** Milde.

Near Chelmsford (7); Inworth, "with slightly scabrous seta" (8) !; Saffron Walden (9).

***E. myosuroides** Schimp.

"On the forest" (2) !; "to such an extent in Epping Forest that sometimes whole trunks are covered with it" (11) !; near Chelmsford (7); Kelvedon (8) !; Saffron Walden (9.)

***E. striatum** Br. and Schimp.

"On banks, very common," Essex (2) !; Epping Forest (11) !; nr. Chelmsford (7) !!; N. Essex (14); Kelvedon (8) !; Chalkney Wood (8) !; Hatfield Forest (13); Saffron Walden (9).

***E. rusciforme** Milde.

Malt Kiln, Epping (11) !; nr. Chelmsford (7) !; Kelvedon (8) !; Stisted !!; Dunmow !!; Saffron Walden (9).

***E. murale** Milde.

N. side of Chingford Church, L. W. Dillwyn (3); Hoe Street, Walthamstow (2) !; Epping Forest (11) !; nr. Chelmsford (7); Springfield Church (7) !; Chignal Smealy !!; Kelvedon (8) !!; Saffron Walden (9).

***E. confertum** Milde.

Epping Forest (11) ! ; Prittlewell (16) ! ; nr. Chelmsford (7) ; N. Essex (14) ; Chignal Smealy ! ! ; Gt. Braxted (8) ! ; Dovercourt (19).

***E megapolitanum** Milde.

Kelvedon (8) ! ; Copford (8) !

Plagiothecium pulchellum Br. and Schimp.

Saffron Walden (9).

***P. denticulatum** Br. and Schimp.

In a wood near Hale End, Walthamstow (2) ! ; Epping Forest (11) ! ; " a variety that occurs on shady banks scarcely ever produces fruit " (11) ; Copt Hall ! ! ; Crane's Wood (11) ! ; Theydon Bois ! ; Mill Green Common ! ! ; Warley Common ! ! ; nr. Chelmsford (7) ; Boreham ! ! ; Broomfield ! ! ; Little Baddow ! ! ; Chantry Wood, Chalkney Wood and Pod's Wood Lane (8) ! ; Norton Heath ! ! ; Hatfield Forest (13) ! ; Dovercourt (19) ; Saffron Walden (9).

var. majus Boul.

Loughton ! !

***P. sylvaticum** Br. and Schimp.

Mill Green ! ! ; Danbury ! ! ; Chalkney Wood (8) ! ; Epping Lower Forest (11) ! ; Broomfield ! !

P. undulatum Br. and Schimp.

Epping Forest (11) ! ; Monk Wood (13) ! ! ; Coopersale (11) ! ; nr. Chelmsford (7).

Amblystegium serpens Br. and Schimp.

" On trees in the Forest " (2) ! ; Epping Forest (11) ! ; nr. Chelmsford (7) ! ; N. Essex (14) ; Broomfield ! ! ; Kelvedon (8) ! ; Copford (8) ! ; Coggeshall (17) ! ; Hatfield Forest (13) ; Saffron Walden (9).

A. irriguum Br. and Schimp.

Hatfield Forest (13).

A. filicinum De Not.

Epping Forest (11) ! ; N. Essex (14) ; nr. Springfield (7) ; Queen's Wood, Great Leighs (7) ; Coopersale (11) ! ; Kelvedon (8) ! ; Messing (8) ! ; Braxted (8) ! ; Bergholt (8) ! ; banks of the Colne, Yeldham (8) ! ; Saffron Walden (9).

Hypnum sub-gen. Campylium**H. riparium** Linn.

"In a pond not far from the back of Paradise Row, Walthamstow" (2)!; "under a bridge nr. the Lea Bridge Road" (2)!; "against a wall in Mr. Todd's horsepond, Marsh Street," Walthamstow (2)!; "on the bank of a brook nr. Shernhall Street," Walthamstow (2)!; Leyton (10); "scarce in gravel pits," Epping Forest (11); nr. Chelmsford (7); N. Essex (14); Springfield!!; Writtle!!; Broomfield!!; waste water near Kelvedon Mill (8)!; in a well, Inworth (8)!; Danbury Common, a somewhat elongated form!!; Saffron Walden (9).

The figure of this species in Dr. Braithwaite's *British Moss Flora* was drawn from the specimen collected at Leyton.

var. longifolium Schimp.

Walthamstow, Epping Forest!!

H. stellatum Schreb.

"In the long bog on the forest beyond the King's Oak" (2)!; nr. Quendon (2)!; nr. Chelmsford (7); Galleywood Common (8)!!; Linguard Common (8)!; West Bergholt Heath (8)!; Saffron Walden (9).

H. chrysophyllum Brid.

Saffron Walden (9).

Sub-genus **Harpidium.**

(In this sub-genus I have had the invaluable assistance of Mr. J. A. Wheldon, the British authority on the group, who has most kindly examined and named all the available specimens. Where specimens do not exist the naming is exceedingly doubtful.)

H. aduncum Hedw.

Nr. Chelmsford (7). (This specimen probably belongs to *H. exannulatum*.)

Group *Typicum* Ren.

var. falcatum Schimp.

Kelvedon (8)! This specimen is almost midway between *var. falcatum* and *var. aquaticum* J.A.W.

var. aquaticum Sanio.

Kelvedon (8) !

Group *Kneiffii* Ren.

N. Essex (14) ; Loughton Forest (13).

var. polycarpon Bland.

Norton Heath !!

var. intermedium Schimp.

Norton Heath !!

Group *pseudo-fluitans* Sanio.

var. paternum Sanio.

Kelvedon (8) ! ; High Easter !!

H. *fluitans* Linn.

The following in the absence of specimens cannot be placed ; some may belong to the next species.

Thomas Warner's gravel pit in the Forest near Woodford Row (2) ; "pond in Greenleaves Lane,"

Walthamstow (2) ; in Walthamstow Marshes (2) ; nr.

Chelmsford (7) ; N. Essex (14) ; Saffron Walden (9).

Group *Amphibium* Ren.

var. jeanbernati Ren.

Loughton !! ; Warley Common !!

H. *exannulatum* Gumb.

"Scarce, Epping Forest " (11).

Group *Typicum* Ren.

var. pinnatum Boul.

Cuckoo Pits, Chingford !! ; Tiptree Heath (8) !

var. pinnatum forma *stenophylloides* Ren.

Epping Forest in a gravel pit (11) ! ; Epping Forest

(19) ; nr. the Earl's Path, High Beach !! ; nr. the

Rising Sun, Walthamstow !! ; Norton Heath !! ; Mill

Green Common (approaching the *var. brachydietyon*.

—J.A.W.) !!

var. brachydietyon Ren.

Norton Heath !! ; Galleywood Common (8) !! ; West

Bergholt Heath (an extreme form diverging strongly towards *var. pinnatum*, due to the less alpine habitat.

J.A.W.) (8) !

var. molluscum Sanio.

Leyton, Epping Forest !!

Group *Rotae* Ren.var. * *falcifolium* Ren.

"Nr. the Menyanthes Bog, Epping Forest" (2) ! ;
Epping Forest (11) ! ; Warley Common (8) ! ; Tiptree
Heath (8) ! ! ; Galleywood Common (an unusually
dwarf form but I have a similar form from Derbyshire.
J.A.W.) ! !

var. *falcifolium* forma *heteroptera* Ren.

High Beach, submerged in a gravel pit, and at
Walthamstow in a similar locality ! !

This is a somewhat puzzling form, which Mr. Wheldon
submitted to Mons. Renauld, who coined the name
for it. M. F. Renauld says, regarding it, "Cette forme
ne se classe pas facilement dans les groupes admis.
C'est un fait qui produit rarement ; mais cependant qui
se produit et j'en ai eu d'autres exemples. La couleur
est celle des formes boreales du group *falcatum*, la
forme des feuilles la nervure forte et tres longue et les
cellules moyennes longues sont du group *Rotae* ; mais
les oreillettes sont peu developpees, mal separees,
presque comme dans le group *amphibium*, et nullement
caracteristiques. C'est cette derniere particularite qui
rend le classement difficile et incertain. Nous sommes
donc en presence d'une forme accidentelle, curieuse,
mais sous importance par son cas isole, par suite de la
structure des oreillettes, qui est en accord avec les
autres caracteres on pourrait la nommer (avec un point
de doute) *H. fluitans* (*Rotae*) var. *falcifolium*, forma
heteroptera."

* *H. uncinatum* Hedw.

Tiptree Heath (8) !

H. commutatum Hedw.

Hickmore Fen Wood (8) ! ; "in a bog in a marshy
meadow nr. Tuddington Parsonage, 1792" (2) !

H. falcatum Brid.

Linguard Common (8) !

[*H. intermedium* Lindb.

This species is recorded for Essex in the *Victoria
History*, but that record is probably based on the
specimen so named in Mr. Varenne's collection, which

proves on re-examination to belong to *H. falcatum*. This species must for the present therefore be expunged from the list.]

Sub-genus Drepanium

H. cupressiforme Linn.

An exceedingly abundant and very variable species.

On trees in the forest very common (2) !; "on forest near the bog and near the gravel pits" (2) !; wood, near Hale End (2) !; Epping Forest (11) !; Monk Wood (13) ; Leyton !!; Theydon !!; Carpenter's Wood, Southend (16) !; N. Essex (14) ; Chelmsford (7) !!; Norton Heath !!; Mill Green !!; Kelvedon (8) !; Hazeleigh (13) ; Chauntrey Wood, Witham (8) !; Tiptree (8) !; Feering (8) !; Hatfield Forest (13) ; Saffron Walden (9).

var. resupinatum Schimp.

"In a wood near Hale End, Walthamstow" (2) !; on the Forest (2) !; N. Essex (14) ; Hatfield Forest (13) ; nr. Quendon (2) !; Mill Green !!

var. filiforme Brid.

"Trunk of a tree, Epping Lower Forest" (11) ; Saffron Walden (9).

var. ericetorum Br. and Schimp.

N. Essex (14) ; Tiptree (8) !

var. elatum Br. and Schimp.

Maldon (19).

H. molluscum Hedw.

Epping Forest, Theydon and Coopersale. This pretty moss cropped up after the lopping in quantity: the third year after it had entirely disappeared (11) !; nr. Chelmsford (7) ; Rivenhall (8) †; Hatfield Forest (13) ; Saffron Walden (9).

Sub-genus Calliergon

H. stramineum Dicks.

Walthamstow, near the Rising Sun; a very curious form (♀) differing from the fell plant of the North of England in its loosely arranged, less appressed leaves !!; Woodham Walter Common (8) !; West Bergholt Heath (8) !

H cordifolium Hedw.

Epping Forest (11)!; margin of the Wake Valley Pond!!; Thrift Wood and Wood by the Ship Inn, Galleywood (7); Wood near Totham (8)!

[H. giganteum Schimp.

This species has been recorded for the county in the *Victoria History*, but all the specimens I have seen collected in Essex and so labelled have proved to belong to the preceding species. The record needs confirmation.]

***H. cuspidatum Linn.**

"In the great bog near Salter's Buildings and the old Windmill, Epping Forest" (2)!; Epping Forest (11)!; Loughton!!; clay pit by Styles, Epping Forest (11)!; Norton Heath!!; nr. Chelmsford (7); Writtle!!; N. Essex (14); Danbury!!; Tiptree Heath!!; Kelve-don (8)!; clay pit near Felix Hall (8)!; Hatfield Forest (13)!; Saffron Walden (9).

H. schreberi Willd.

"In a hedge, Loughton and elsewhere, not uncommon" (2)!; Epping Forest (11)!; Loughton!!; Mill Green!!; nr. Chelmsford (7); Galleywood Common (8)!; N. Essex (14); Woodham Walter Common (8)!; Tiptree Heath (8)!; Saffron Walden (9).

Hylocoimum splendens Br. and Schimp.

Hale End (2)!; Epping Forest, very scarce (11)!; Monk Wood (13)!; Epping Lower Forest (11)!; Tiptree Heath (8)!; Saffron Walden (9).

H. loreum Br. and Schimp.

Hatfield Forest (13).

H. squarrosum Br. and Schimp.

On the Forest (2)!; nr. Hale End (2)!; Epping Forest (11)!; Loughton!!; Ramsden Heath (7); Mill Green!!; N. Essex (14); Tiptree Heath (8)!; Chauntrey Wood, Witham (7); Hatfield Forest (13); Saffron Walden (9).

***H. triquetrum Br. and Schimp.**

On Forest, very common (2) !; Loughton (2) !; Epping Forest (11) !; nr. Chelmsford (7) ; N. Essex (14) ; Chalkney Wood, Earls Colne (8) !; Saffron Walden (9).

[The Club is greatly indebted to Mr. Chittenden, not only for collating the information concerning the Museum Herbaria of Mosses, and identifying doubtful examples, but also for actually mounting and arranging the specimens. Mr. Chittenden's work in this way has been of the highest Museum value and a great aid to the Curator.—ED.]

**ON THE SALINITY OF THE SEA-WATER
ALONG THE COAST OF ESSEX.**

By H. C. SORBY, LL.D., F.R.S., F.L.S., F.G.S., &c.

[Read October 27th, 1906.]

FOR a number of years (1884 to 1888, both inclusive) I systematically studied the salinity of the water along the coast and in the estuaries of Essex, and found that one of the most important facts in connection with the distribution of the marine animals was the difference between the density of the high and low water. My results, however, apply only to the summer months, from the early part of May to the latter end of September; and no doubt they differ widely from the conditions in winter. The comparative salinity was determined by a hygrometer, which was far the most convenient method on board a yacht.

What struck me much was that in some years at Burnham on-Crouch the density of the low water was greater than at high water; and, in passing up the river to Battles Bridge, the density became greater and greater. To my surprise I found the well-marked Alga, *Chorda*, growing in some quantity not much below Battles Bridge in 1885, when the density of the water was very high, but I looked for it in vain in 1885, when the density was much lower. I do not remember seeing it elsewhere along the coast of Essex. This excess in density in

particular years is, of course, easily explained by greater evaporation and smaller rainfall.

I have observed similar facts at Paglesham and West Mersea, but not in Brightlingsea Harbour and the adjoining creeks, or in Harwich Harbour and up the Stour.

It thus appears that, at all events in the summer of certain years, the water in some of the Essex estuaries is even more salt than the water outside coming in with the high tide. Along the coast of Essex in summer the sea-water is also somewhat more dense than that of the contiguous part of the North Sea.

The following table shows the mean densities of the water in summer off the coast, and at high and low water in the estuaries, and the differences, plus or minus, of the low water compared with the high. As will be seen, these differences, though not great, are well marked. It will also be observed that, at all events in summer, the water in the estuaries would be very suitable for the purposes of salt-making by evaporation.

				High.	Low.	Difference.
Burnham, 1885	...	...	...	26·37	26·76	+ ·39
„ 1888	...	...	...	25·92	24·36	- 1·56
Near Battles Bridge, 1885	...	...	...	27·24		
„ 1888	...	...	...	22·33		
Paglesham	...	...	...	25·36	24·92	- ·45
„ 1885	...	...	...	26·45	27·28	+ ·83
West Mersea, 1886	...	...	...	26·19	26·54	+ ·35
Brightlingsea Harbour	...	...	...	25·90	25·07	- ·83
Pyefleet, mean	...	...	...	25·86	23·86	- 2·00
„ 1885, maximum	...	...	...	26·27		
Harwich Harbour	...	...	...	25·66	25·18	- ·48
Open water off the coast, mean	...	...	...	26·53		

N.B.—All these numbers refer to the excess of density above rain water, reckoned as 1000. Thus, in the case of the first item in the above list, I give 26·37 instead of 1026·37, which shows the effect of the salts more distinctly, independent of the weight of the water.

**THE CORRESPONDING SOCIETIES'
COMMITTEE OF THE BRITISH ASSOCIATION,
YORK, 1906.**

REPORT OF THE CLUB'S DELEGATE,

F. W. RUDLER, I.S.O., F.G.S., *Secretary of the Conference of Delegates.*

[*Read November 24th, 1906.*]

AT the first meeting of the Delegates held under the chairmanship of Sir Edward Brabrook, C.B., who fitly represented the new group of "Associated Societies," the chief subject for discussion was that of Meteorology. Dr. H. R. Mill, the distinguished authority on rainfall, introduced the subject by an admirable address, in which he commended the study of meteorology as one peculiarly fitted for cultivation by provincial societies, inasmuch as it needed for its prosecution comparatively simple appliances, whilst it developed habits of strict accuracy and method in the observers. At the same time it contributes to the advancement of knowledge in directions much needed. The determination of local climate can be best effected by the work of local societies, since it requires long continuous records usually beyond the power of individual observers. Dr. Mill remarked that a society should be, by its nature, immortal—a remark which, it is hoped, may be applied to the Essex Field Club. But as our Club does not contemplate the formation of a meteorological station the subject need not be enlarged upon.

Of more direct interest to the Club were the proceedings at the second meeting. This was held under the chairmanship of Mr. John Hopkinson, for many years the honorary secretary of the Hertfordshire Natural History Society, and was attended by the President of our Club. The main subject of discussion at this meeting was that of County Photographic Surveys, which was introduced by Mr. W. Jerome Harrison, of Birmingham. In an elaborate paper Mr. Harrison traced the history of the survey movement, which was really initiated by him, when, in 1889, he proposed a photographic survey of Warwickshire. From Warwickshire the work has spread, and surveys are now in active operation in Worcestershire, Kent, Surrey, Yorkshire, and Edinburgh, as well as in Essex. Mr. Victor Taylor had kindly sent your delegate some notes on the photographic survey of Essex, which he used. Mr. Harrison

advocated the appointment of a Committee, which should (1) collect details as to the exact work already accomplished, (2) circulate printed matter making the aims and methods of the surveys widely known, (3) endeavour to co-ordinate the photographic societies on the one hand, and the literary and scientific societies on the other, so that all may unite in the work of the survey, (4) obtain lists of experts willing to advise on details of the work, and (5) secure the publication of series of prints dealing with either districts or subjects.

The delegates who were present warmly supported Mr. Harrison's project, and it was proposed to secure, if possible, at next year's meeting of the British Association at Leicester, the appointment of a County Photographic Committee. It may be noted that in the course of the discussion Dr. H. H. Turner, F.R.S., professor of astronomy in the University of Oxford, pointed out the desirability of taking photographs on stereographic principles, for use in making a ground-plan of the objects photographed as explained in the *Monthly Notices of the Royal Astronomical Society* for December, 1901, p. 126.

SEA BREAM IN ESSEX WATERS.

By JAMES MURIE, M.D., LL.D., F.L.S.

SO far as I am aware there is no record of the Sea-Bream (*Pagellus centrodontus*) having been met with strictly within Essex waters. Dr. Laver does not mention it in *The Mammals, Reptiles and Fishes of Essex*,¹ or in his additions since in the *Victoria History*, Vol. I.

Neither to my knowledge is it included in any of Mr. E. A. Fitch's lists of captures in his various notes in several volumes of the *ESSEX NATURALIST*. The above two naturalists being reliable authorities on our local fish-fauna, their silence doubtless betokens absence of information thereon. I have, however, been fortunate enough to obtain a true Essex example, inasmuch as it was obtained within half a mile of low-water mark.

The fish in question was caught by one of our Leigh white-baiters, Harry Johnson (best known by nickname—"Roughy"), on 5th November last (1906). He and his mate were then using the stow-net, between the Crow Stone and the end of

¹ *Essex and Morf. Essex Field Club*, Vol. III.

Southend Pier, in water about three fathoms deep. The fish was new to them as others of fishermen at work hard by. When fresh caught its brilliant silvery scales immediately attracted attention. According to the men its head and dorsum were only slightly tinted with pale orange pink, the silvery hue visibly predominating. Such certainly was the case when brought to me. Moreover, it was destitute of the black shoulder patch so specifically characteristic of the full-grown *Pagellus centrodontus*.

Extreme length, $9\frac{1}{4}$ inches. It barely turned the scale at $\frac{1}{2}$ lb. weight. Greatest depth of body just behind the pectoral fin 2.9 inches. Eye $\frac{1}{3}$ this of an inch in diameter. Sex doubtful. Food, quite a number of young of the Greater Pipefish (*Sygnathus acus*) ranging from $2\frac{1}{4}$ to $3\frac{1}{2}$ inches in length; also a post-larval Butterfish or Gunnell (*Centronotus gunnellus*) 38 mill. = $1\frac{1}{2}$ inches long.

This Essex specimen of immature Sea Bream (yearling or thereabouts) seems to come under what are known by the local name of "Chad" by the Devon and Cornwall fishermen. Theirs is an indefinite term for the young bream of various sizes destitute of the adult's dark-coloured shoulder mark and deep orange hue of the dorsum. Our estuary example may have been a straggler from a roving squad; for in their immature stages during the autumn months they crowd in shoals among the inshore shallows of the above counties, whereas the older bream are stated to keep to deeper water and more rocky grounds.²

The species in question may be said to have its headquarters quite within the western area of the English Channel. At times it is plentiful and exposed for sale in the fish-marts of Plymouth and Brixham.³ There seems to be a gradual diminishment in numbers, proceeding eastwards, up channel. For example, on the Sussex coast,⁴ they are relatively fewer, and still less so around Kent, which, indeed, somewhat resembles Essex in paucity of their visits. On the Suffolk and Norfolk seaboard they are now seldom caught.⁵

It was originally intended that the specimen of Thames Estuary Sea Bream should have been exhibited to the members

² Wilsons, *The Sea Fishes of England*, 3rd Ed., 1873, p. 189.

³ Houghton, *Commercial Sea Fishes*, 1886, p. 192.

⁴ Yarrell, *Fauna Fishes*, 3rd Ed., Vol. II, p. 147; also Marshall, *Natural History of Brighton* (1856), p. 112.

⁵ Patterson, "Fishes of Great Yarmouth," *Zoologist*, 1897, p. 211.

of the Club on the reading of this paper, and afterwards deposited in the Essex Museum of Natural History. As it happened, Mr. Boulenger, of the British Museum, requested it for the National Collection, where it can now be consulted by those interested.

P.S.—Since this paper was in type, on comparing the description here given with the preserved specimen in the British Museum, there is a distinctly appreciable, but rudimentary, condition of dark spot behind the upper part of the operculum. It consists of some five pigmentary serrations above, and as many below, the commencement of the lateral line. Mr. Boulenger remarks that he has previously observed spirit immersion bring out markings barely visible in the fresh condition of other kinds of fish.—J.M.

The Daffodil Fly in Essex.—This fly, *Merodon equestris*, appears to be spreading in Essex and likely to become a pest of economic importance in the county as a destroyer of daffodil bulbs. The fly, a Dipteron, belonging to the Syrphidae, appears in May, and is exceedingly bee-like, having its abdomen, as a rule, covered with foxy hair, but very variable both in size and coloration. When flying it emits a very shrill sound and has the habit characteristic of many of the Syrphidæ of remaining poised in the air for a time, and then of suddenly darting a distance of about a yard away. It lays its eggs near the base of the daffodil leaves, and the grub hatching in July eats its way into the bulb, afterwards making a hole to the outside through the side or base of the bulb, through which it can dispose of its ejection. The grub, which is legless, and dark gray or blackish in colour, reaches a length when full grown of about $\frac{3}{4}$ -inch. It turns into a black pupa in November, in those cases I have had an opportunity of examining, outside the bulb in the soil. The only means of dealing with the pest appears to be to wait until October is well advanced before planting the bulbs and then to reject and burn all those that feel soft owing to the eating away of the interior of the bulb.

FRED. J. CHITTENDEN, *Biological Laboratory, Chelmsford.*

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The assistance of all interested in Essex is solicited for this work, which is not only fascinating in itself, but as years go on will become of considerable historical and scientific importance. A complete set of the 6-inch Ordnance Survey Maps of Essex have been obtained to aid in the localisation and registration of the pictures.

The *Hon. Secretary*, Mr. Victor Taylor, *Hurstleigh, Buckhurst Hill, Essex*, will gladly correspond on the matter, and will give full information on the objects and work of the Survey.

The Fauna and Flora of Essex,

As Illustrated in the
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I need not point out to my fellow Members and friends the great difficulty often experienced in obtaining authentic specimens from a limited district. I should highly esteem any aid that County and London Collectors could afford. Localised specimens of Essex Birds, Fish and Mammals, Insects of all orders, Land and Freshwater and Marine Shells, Plants, etc., if in good condition, will be of the greatest assistance, and donors will have the satisfaction of knowing that their specimens will be properly preserved, and will be available for study in the future.

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WILLIAM COLE,
Hon. Secretary and Curator.

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